

MECHANIX ILLUSTRATED®

NOVEMBER

20¢



Jet-Powered Air-Sea Liner
Lands and Takes Off on Skis

WEIRD UNDERSEA EYE SEEK

HOW TO FIND BARGAINS

DIO-28-2M-11-53

CHRIST VELLINE
315 LEWIS AVE
BILTINGS MONT



AIR-SEA JETLINER

AFTER months of top-secret tests, the Navy has partially lifted the wraps on its XF2Y-1 Sea-Dart, world's first delta-wing seaplane, which uses retractable hydro-skis for take-off and landing.

MI's cover and the Convair drawing above show what this sensational development may mean to commercial air travel of the future. Imagine a supersonic jetliner, too large to be handled efficiently at even our largest airports but perfectly capable of squatting at any of our innumerable seaports and being nuzzled to its dock by tugs! In addition to passenger convenience and greater capacity is the extra safety factor in trans-oceanic hops. •



Hydro-skis, shown extended immediately after water take-off, retract when plane is in flight.

The Sea-Dart ready for take-off. Wings and tail are triangular. Elevons take place of ailerons.

Convair's new fighter needs no special beaching gear. It runs up on its skids and own power.



10^c

A FAWCETT PUBLICATION
MAY

MECHANIX ILLUSTRATED

now 10^c



STRANGE WAR PLANES
SEE PAGE 41

BUILD THIS MODEL • PAGE 64

THIS MAGAZINE GUARANTEED!

Satisfaction or Double Your Money Back • See Page 4

Our Air Force—A Farce!



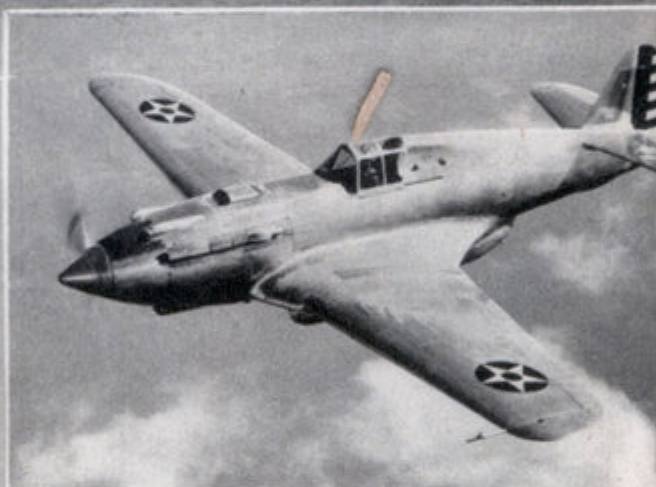
"We are five years behind England and Germany in planes, engines and equipment and a full 10 years behind in the development of our air force as a third arm of defense."

by Major Al Williams

AMERICA is not an airpower! We have, instead, two flying services—one with the Army and the other with the Navy—and they are not adequate for the defense of the nation.

As airpower goes, I estimate that we're about five years behind Europe's leaders in planes, engines, and equipment, and a full 10 years would be needed for the maturity of a brand new service. This goes in spite of a European demand for American fighting ships, in spite of "downhill" speeds of from 575 to 700 m.p.h. claimed for blunt-nosed radial engined planes, and in spite of a college-student civilian training program which portends to be a solution to the pilot problem.

Our air-cooled engines are good, and hold



Top: This strange looking craft is the sensationally new Lockheed XP-38 mid-wing monoplane equipped with twin Allison liquid-cooled engines. The double-fuselage plane was built experimentally for the Army. Officially called the newest and fastest fighting plane, this photo was taken just prior to its take-off for what proved to be a near-record cross-continental flight made in slightly over 7 hours.

Above: This is a single-engine Curtiss XP-40 equipped with an Allison liquid-cooled motor. It is one of the newest single-seat fighters built for the Army and is claimed to have a top speed in excess of 400 miles per hour.

their own with foreign radials. Our ships came in handy in the scramble for planes after the Munich incident; they are fill-ins for building programs that weren't geared to air war. But they are powered by engines which can't approach the English Rolls-Royce streamlined power plants, for instance, and none of the planes is in the same speed bracket with standard fighting ships of the airpower nations.

In my opinion, the most significant development in American military aviation in recent years came recently when the Army super-speed XP-38 Lockheed streaked across the continent in a little more than seven hours. That plane was powered by two Allison streamlined, liquid cooled engines, and it could mark the fulfillment of enduring prophecy and the beginning of America's true performance in the air. It picks up speed research where a little Navy biplane left off 16 long years ago.

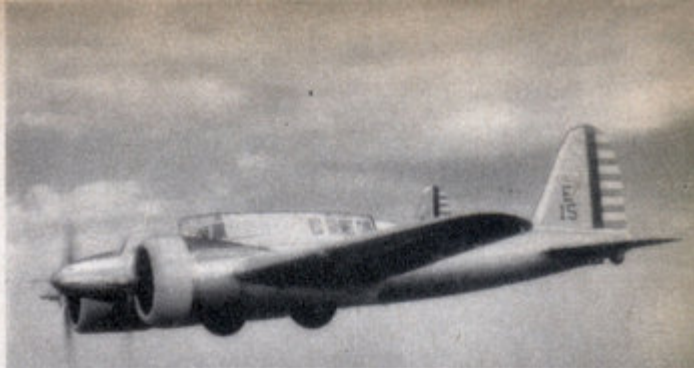
The biplane was a sleek, streamlined little ship powered by a Curtiss D-12 engine, an in-line and water-cooled plant. It slid through the air with less resistance than any ship of its period, and its record of 266.6 m.p.h. was made when no service plane was tipping 150. I flew that ship to its laurels, and its speed stood briefly as the world's record and for eight years as the American speed record. It stood as our record for so long because the reactionaries, headed by the then Assistant Secretary of the Navy for air, declared that 266.6 m.p.h. was all the speed we could use.

Jimmy Doolittle, of the Army, (I, then a pilot for the Navy), and many other ambitious youngsters envisioned speeds of 300 and 400 m.p.h. and up and were anxious to fight for them. We lost out, though, and first the Navy and later the Army abandoned the in-line engines in favor of the radials. Never since has the United States held the world's speed record, which at present is held by Italy at 440 m.p.h.

The new type twin-engine Army ship hasn't brought us out of the woods, although it does blaze a trail. It isn't "probably the fastest in the world," as announced at the time of its appearance. Last summer I flew one German ship whose prototype approached the top speed claimed for the Lockheed, and saw

Below: U. S. Army official photograph of the Boeing XB-15 "super-flying fortress" being tested by the Army. This air-giant is powered by 4 one-thousand horsepower engines built by Pratt & Whitney. Largest of the bombers designed for our air force, it is for long-range flying.

Below right: Northrop A-17, two-seat attack monoplane with detachable wing-tips. Equipped with 750 hp. radial engine. Top speed is 310 m.p.h. Climbs 2,500 ft./min.



Above: Official Army photo of the Curtiss Y1A-18 powered with two single-row, 9-cylinder Cyclone engines. This attack job was recently tested by the 3rd Attack Group, G.H.Q. Air Force.



Above: This small low-wing monoplane, known as the "Interceptor" because it is intended to intercept bombers before they reach their destination, is an Army experimental job built by Curtiss. Equipped with a super-charged 600 hp. motor, the plane will climb 5,000 feet in 1.6 minutes. Speed is 304 m.p.h. at 17,000 ft. Armament consists of two machine guns.



Above: Seversky P-35, single-seat fighter monoplane equipped with 950/1000 hp. Pratt & Whitney, 14-cylinder radial engine. Top speed at 10,000 feet is 300 m.p.h. Cruising range is 1200 miles. Armament consists of two machine guns and light bombs.





NORTH AMERICAN BT-9

Above: North American BT-9 is an Army two-seat advanced training monoplane equipped with a 400 hp. Wright air-cooled engine. Maximum speed is 171 m.p.h. and landing speed is 56 m.p.h. This plane is especially equipped for training in blind flying.



DOUGLAS O-43

Above: The Douglas O-43 is a two-seat Army observation plane. It is a wire-braced "gull-winged" monoplane with 675 hp. liquid-cooled Curtiss Conqueror engine. Top speed is reported at 188 m.p.h.



CURTISS A-12

Above: Curtiss A-12 two-seat attack, low-wing monoplane designed for the Army. It is equipped with a Wright "Cyclone" 9-cylinder, 750 hp. engine and has a top speed of 192.5 m.p.h. It has four machine guns.



Left: Brewster XF 2A-1, Naval shipboard experimental fighter. It is a mid-wing, all-metal monoplane equipped with completely retractable landing gear. Armament consists of two machine guns in top cowling.



Above: Major Al Williams is shown beside his famous Navy Curtiss racer equipped with a Curtiss D-12 liquid cooled engine, in which he won the Pulitzer race at St. Louis in 1923, with a speed of 266.6 m.p.h.

another type which outdid it by 35 m.p.h.

It isn't 100 miles an hour faster than single-engined foreign ships, and I know that from time at controls, too. It isn't an innovation, for upon my return from Europe last summer I reported a twin-engined, streamlined fighting plane—also a single-seater—which can outdo the aerobatics of any single-engined plane.

But the new American ship is a tribute to the Army Air Corps' initiative and to the perseverance of the Allison Engineering Corp. It's an example of what should be going on all over the country, for speed is the essence of airpower, and research is the only way to speed. And even after a good engine is developed, a long period of teething trouble is ahead of it. It's a hard grind from the experimental stage to the standard fighting ship rating. In all these things, we trail Europe.

Our nearest approach to actual air power lies in the General Headquarters Air Force.

Before 1935 the Army Air Corps was scattered throughout the country, and in charge of nine different Army Corps Area commanders—all generals of infantry, cavalry, or artillery. As could be expected, they operated as nine separate forces. If the pilots of the first pursuit group at Selfridge Field, Michigan, wanted to fly to New York, for instance, they had to get permission from the Corps Area Commander. The GHQ Air Force was established in 1935 as an experiment. Later, when Major General H. H. "Hap" Arnold took over control of the Army Air Corps in 1938, he said he was going after some faster fighting planes. He meant business, as witness the new twin-engined



Above: Official U. S. Army Air Corps photo of the Martin B-10 bomber designed for the Army G.H.Q. Air Force. This mid-wing job is equipped with two radial engines and is designed especially for service on the Pacific Coast.

streamlined Lockheed. He's dug into the defense problem with his "blackout" rehearsals, and the long range work of his corps is best attested to by the "Flying Fortress" flights to South America.

I've got a lot of respect for "Hap" Arnold. He flies his own ship, and that dates back to 1911. He's a flying man's pilot, and a flying man's executive.

The GHQ force illustrates the merit of a separate air force, but it isn't a separate air force in any sense of the word. It's a compromise, and it provides the reactionaries with a handy answer for air power appeals without stripping the control from their hands. While the force nominally operates under its single command, it nevertheless is subordinate to the General Staff and is restricted to land operation. (The Navy's jurisdiction prohibits the Army force from flying more than 100 miles to sea.)

The GHQ Air Force is dependent on a parent service, but it isn't living in the same house. That little taste of independence and opportunity for initiative has produced results, and gives us a glimpse of what our air force should and could be.

Each time our fighting aviation services have shown promise of being able to run a war independently of the land and sea forces, Army and Navy leaders jumped on the idea and pushed our errand boy aviation back to its original status. That's where it is today and whether our Army and Navy can be compelled to acquiesce to any reorganization is the first "question" in the popular desire for air protection.

[Continued on page 101]

Right: Northrop BT-1, two-seat dive bomber monoplane equipped with 750 hp. Pratt & Whitney engine. Designed as a Navy attack ship; performance figures are confidential. Note that landing gear is partly retractable.

formerly *Modern Mechanix*



Above: Curtiss SBC-3 two-seat scout bomber designed for the Navy. This biplane is equipped with a Pratt & Whitney radial engine. The Navy purchased 141 such planes and is keeping performance figures a secret.



Above: Consolidated's experimental patrol bomber XPB2Y-1 designed for the Navy and equipped with four 1,050 hp. Whitney "Twin-Wasp" engines. Pilot's compartment is near leading edge of wing. Gunners in nose and stern; navigator amidship. Equipped with sleepers and kitchen. Details of arrangement and performance factors are held confidential by Navy.



Above: Grumman F3F-1 developed for the Navy and equipped with a 650 hp. "Twin-Wasp Junior" engine. Maximum speed is 240 m.p.h. at 7,500 ft. Landing speed 65 m.p.h. Two fixed Browning machine guns are mounted to fire through the propeller.



Our Air Force—A Farce!

[Continued from page 57]

The Army needs the planes assigned to it—so does the Navy. Neither outfit dares to move without information from its "eyes." Neither can afford to waste ammunition without firing directions from its elevated fire control stations on wings. The sensible solution is to give the fleet and the army a thousand planes apiece, let them use them as they see fit.

We have enough air services. What we need is a great air force enabled to handle all air defense affairs, to work out the promising and dreadful future of air power, and give us the only kind of defense there appears to be against massed air attack. The Army and Navy do not offer us such protection in their service operations, and neither one's air service is strong enough to ward off the determined attack of a real foreign air power.

For all the expense of aviation and the losses which come with new types, it is a comparatively cheap operation. For the cost of one battleship, it is possible to buy about 500 gigantic bombers such as the Boeing Company calls "Flying Fortresses."

These bombers carry two 1,000-pound bombs. Five hundred times 2,000 is one million pounds of trouble that can be sent where they will do the most damage and far beyond where any fleet or army can think of going.

While it is true that the battleship will last upwards of 20 years, the fact that it preserves well does not increase its effectiveness in modern warfare. It is not protection or defense against an air raid.

The navy sees aviation's duty as an arm of the fleet, and has divided its operations into four general groups; tender-based patrol bombing planes, seaplanes operating from battleships and cruisers, landplanes operating from aircraft carriers, and the aviation detachment of the Fleet Marine Corps forces.

None of these departments is set up to project a true air war, nor to thwart a determined attack. The long range patrol bomber has been the outstanding development in Naval operation during the past few years, and the routine transfer of whole squadrons from California to Hawaii and to the Canal Zone has emphasized the key part these big flying boats are playing in the Navy's long-range tactical program.

But flying boats suffer by comparison to land planes, and it is noteworthy that the air power nations are concentrating on the latter type. It costs much horsepower to lug the bulky hull of a flying boat through the air, and this cuts sharply into the bomb load which can be carried. For all their size and horsepower, our patrol bombers—even the new four-engined flying battleships—can accommodate only a negligible bomb load for long-range work. Negligible, I say, as compared to the load the landplane counterpart could haul.

The attempt of any navy to operate air power is awkward from the start. In tying the operation to

[Continued on next page]

THE NEW CORONA Zephyr



ONLY
\$29.75

All prices
subject to revision.

L. C. Smith & Corona Type-
writers Inc. Desk 5, 187 Almond
Street, Syracuse, N. Y. Please send
me free folder describing Corona Zephyr.

Name _____

Address _____

City _____

State _____

*"I've Never Made
Money So Fast
in My Life!"*



**"20 HOURS BROUGHT ME
\$52.50 CASH PROFIT"**

Without any experience in calling on gasoline stations, R. L. Rich was handed a machine he had never seen before.

In a one minute demonstration, he showed how the garage owner could double or triple his profitable oil sales by GIVING AWAY a service job. Tremendous national advertising campaigns, on which hundreds of thousands have been spent already, have sold the public the need for this service.

Rich made his first call—

PFITT—and the Sale was Made!

He made forty calls in 20 hours. He sold thirty machines. He made \$1.75 cash on each sale. He pocketed \$52.50 on Thursday, Friday and Saturday morning.

The whole country is open now to men like Rich. Nothing has been reserved. This is brand new. Opportunities are unlimited. Earning possibilities stagger the imagination.

FREE—Send Name

Do you want to cash in? Don't send money. Nothing for you to buy. Send your name on a postcard or send the attached coupon, or send a telegram. By the quickest way you know, get your name to us for complete details of what promises to be the most spectacular money-maker of the year.

**ACE EQUIPMENT CO., DEPT. 625
Walnut Bldg., DES MOINES, IOWA**

Ace Equipment Co.,
Dept. 625,
Walnut Bldg.,
Des Moines, Iowa.
Rush all facts, pictures, operation details and cost and profit figures on your new machine. Everything is Free. I am not obligated in any way. (Write name in margin of this page and mail).

Due This Year: Trains That

Electric cars will soon cut travel time between New York and Washington, in a bold U. S. program to speed travel by rail

By ALDEN P. ARMAGNAC

DRAWINGS BY HENRY B. COMSTOCK

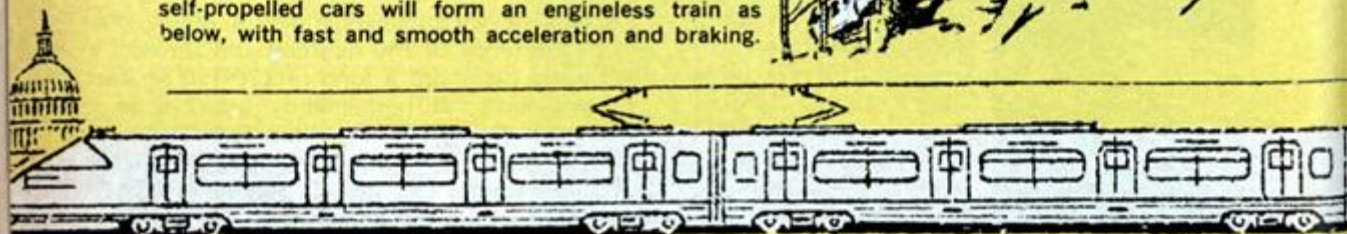
All a-BOARD! *Psshhh*—the doors slide closed. The silvery train leaps forward. Back into your seat cushion you go, as if in an airplane taking off. No nonsense about it, this train's really going to ride—in just 150 seconds it will accelerate to 125 m.p.h., more than two miles a minute. For it aims to get you to your destination in a travel time matching that by air—maybe less.

Americans are due to ride the first of these superspeed trains this year, possibly as early as next fall. That's when delivery is expected of a substantial part of a fleet of 50 self-propelled electric passenger cars, capable of a record-breaking top speed of 150 m.p.h. Assembled in engineless trains of four to 10 cars, they'll immediately go into actual passenger service on the Pennsylvania Railroad's 226-mile line between New York and Washington.

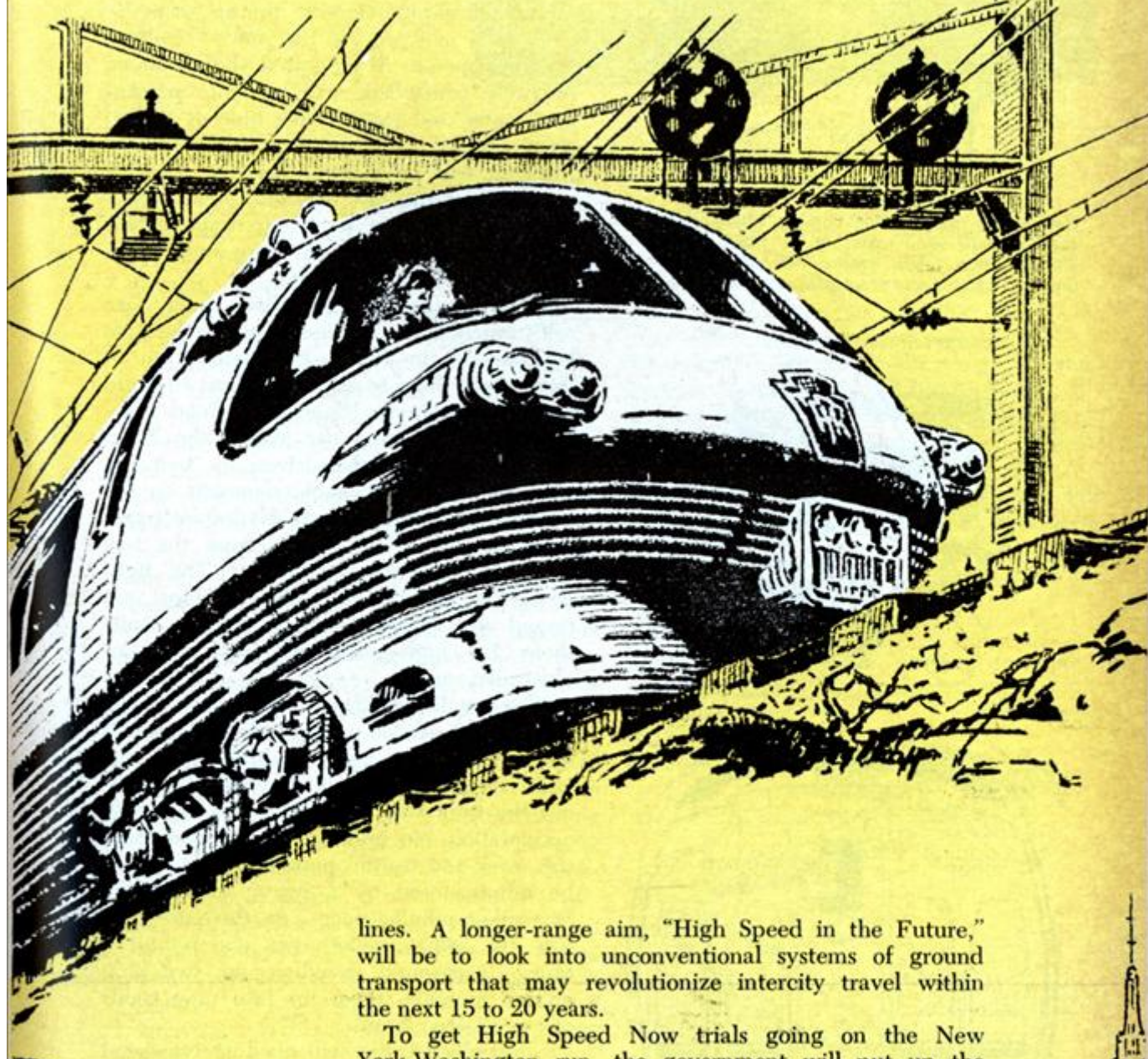
At the same time or soon after, three to five passenger cars propelled by gas turbines are scheduled to inaugurate extra-fast service on the New Haven's 45-mile run between Boston and Providence.

U. S. sparks the program. The exciting new high-speed trains will be the first result of a three-year, \$90-million U. S. program to speed travel on land. Sponsored by the Department of Commerce, the bold project has just been launched by Congress' passage of the High Speed Ground Transportation Act of 1965. Its initial aim, which might be called "High Speed Now," will be to demonstrate how far today's technology can boost the speed of railroad travel on existing electric and non-electric

High-speed trains of new electric cars, capable of 2½ miles a minute, will get passenger-carrying trials on Pennsy's New York-Washington line. Four to 10 of the self-propelled cars will form an engineless train as below, with fast and smooth acceleration and braking.



Can Go 150 M.P.H.



lines. A longer-range aim, "High Speed in the Future," will be to look into unconventional systems of ground transport that may revolutionize intercity travel within the next 15 to 20 years.

To get High Speed Now trials going on the New York-Washington run, the government will put up the money to buy 28 of the 150-m.p.h. cars. The Pennsy, maintaining that a conclusive test will take 50, plans to buy the rest. They may be under construction by the time this is read. While prospective bidders still awaited detailed specifications at this writing, advance reports of

Continued



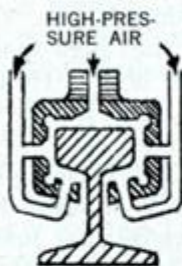
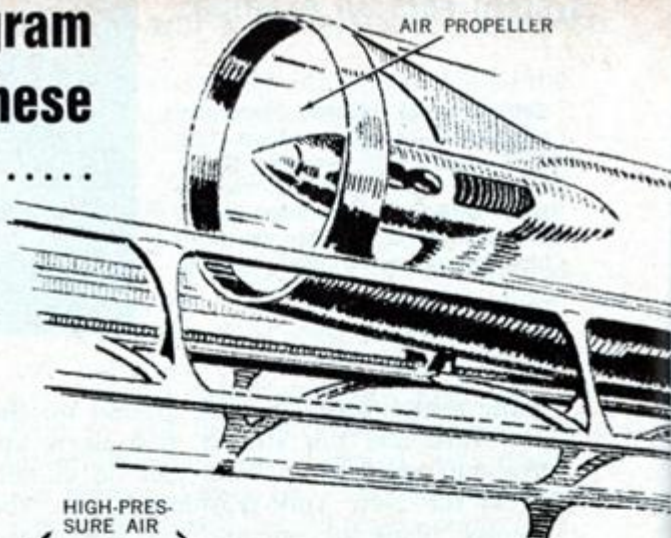
For the future, U. S. program eyes vehicles like these

U.S. experts consider spending federal funds a worthwhile gamble to try to start American trains whizzing.

Speed records so far, for U.S. diesel and electric trains on scheduled runs, are 82 m.p.h. for the Burlington's diesel-powered Morning Zephyr and 71 m.p.h. for the Pennsy's electric-powered Manhattan Limited—both for less than 50 miles. Abroad, France's famed Mistral express averages 80 m.p.h. for 318 miles, one stop included. But all these marks have lately been eclipsed on a remarkable Japanese railway, the just-opened New Tokaido line between Tokyo and Osaka.

A Japanese example to shoot at. Setting world records, engineless Japanese trains of self-propelled electric passenger cars hit a top speed of 126 m.p.h. They cover the entire 322-mile distance, two stops included, in 190 minutes—for an average speed exceeding 100 m.p.h.

Encouraged by this example, U.S. experts nevertheless are wary of copying it. Built from scratch especially for high speed, the new line cost about \$1½ billion—and a 450-mile counterpart of it between Boston and Washington would have a price tag



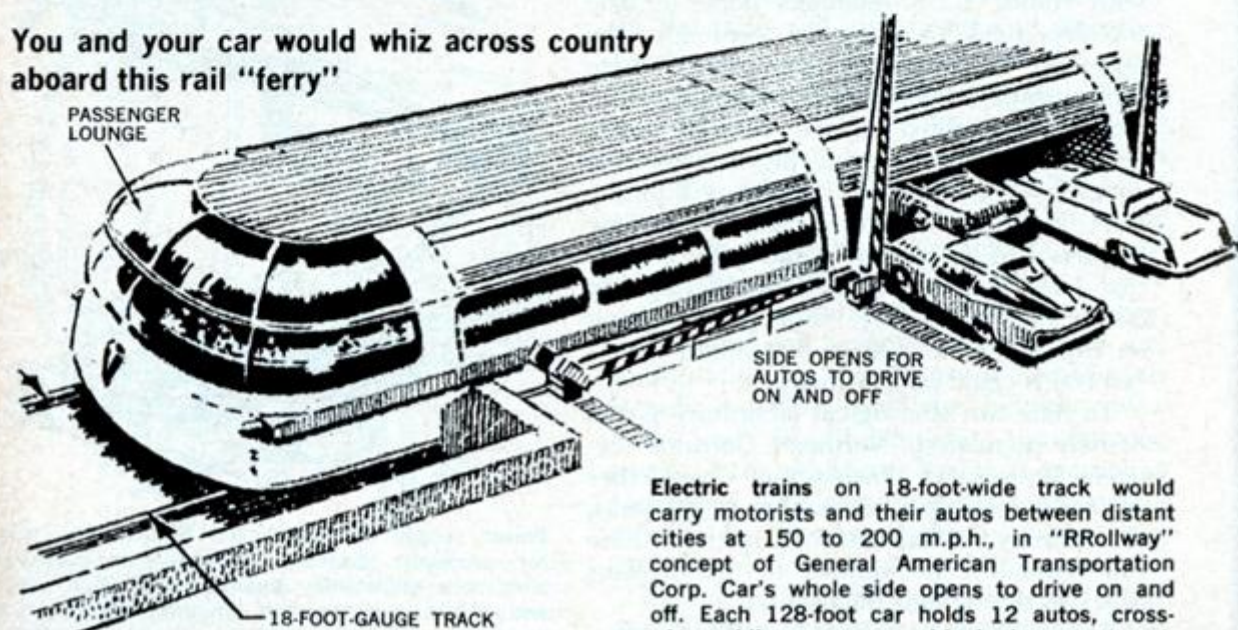
This train would glide on air

Air-fed slippers, of which this version fits around standard rail, would support Ford "Levacar" on air film a few thousandths of an inch thick.

between three and four billion. Instead, the federal program favors a much more modest outlay to show what can be done on today's U. S. lines—and, meanwhile, to investigate coming developments that may make even a Japanese-style high-speed railway obsolete.

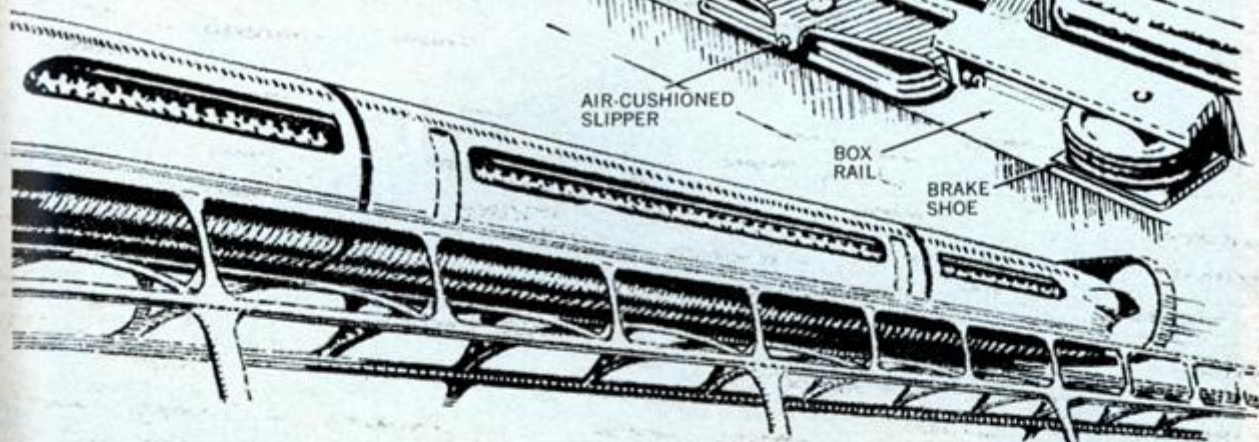
Seen ahead are systems of land travel to carry passengers at 100 to 250 m.p.h.,

You and your car would whiz across country aboard this rail "ferry"



Electric trains on 18-foot-wide track would carry motorists and their autos between distant cities at 150 to 200 m.p.h., in "RRollway" concept of General American Transportation Corp. Car's whole side opens to drive on and off. Each 128-foot car holds 12 autos, cross-wise, while passengers ride in lounge at end.

On boxlike rails, "Levacar" could use air-supported slippers of this alternate design. Drawing also shows how brake shoes could be built into the slipper assembly.



Wheelless "Levacar" designed by Ford Motor Co. would apply ground-effect principle to glide along rails on air film at 100 to 500 m.p.h. Driven by turboprop engines and air propellers, the 124-foot Levacar train pictured above would carry 200 passengers. Rails of track could have either standard or boxlike cross section.

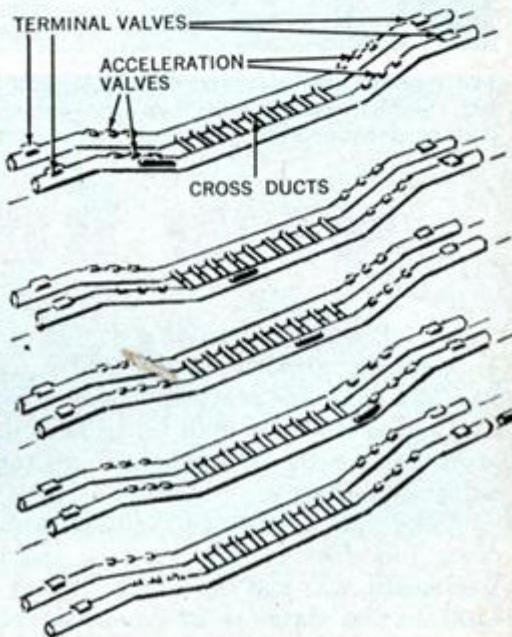
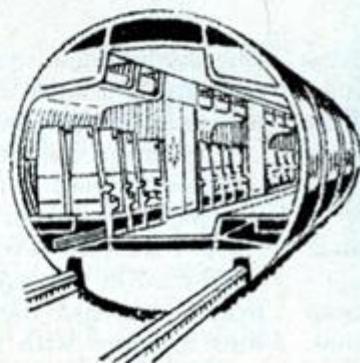
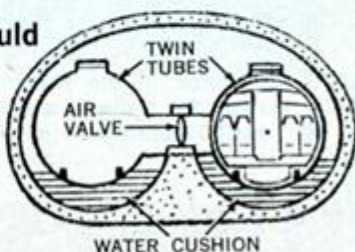
or more—in vehicles so radical that their tracks no longer are called railways, but "guideways." More than half the federal program's funds will go for the first really thorough study of a variety of these far-out schemes.

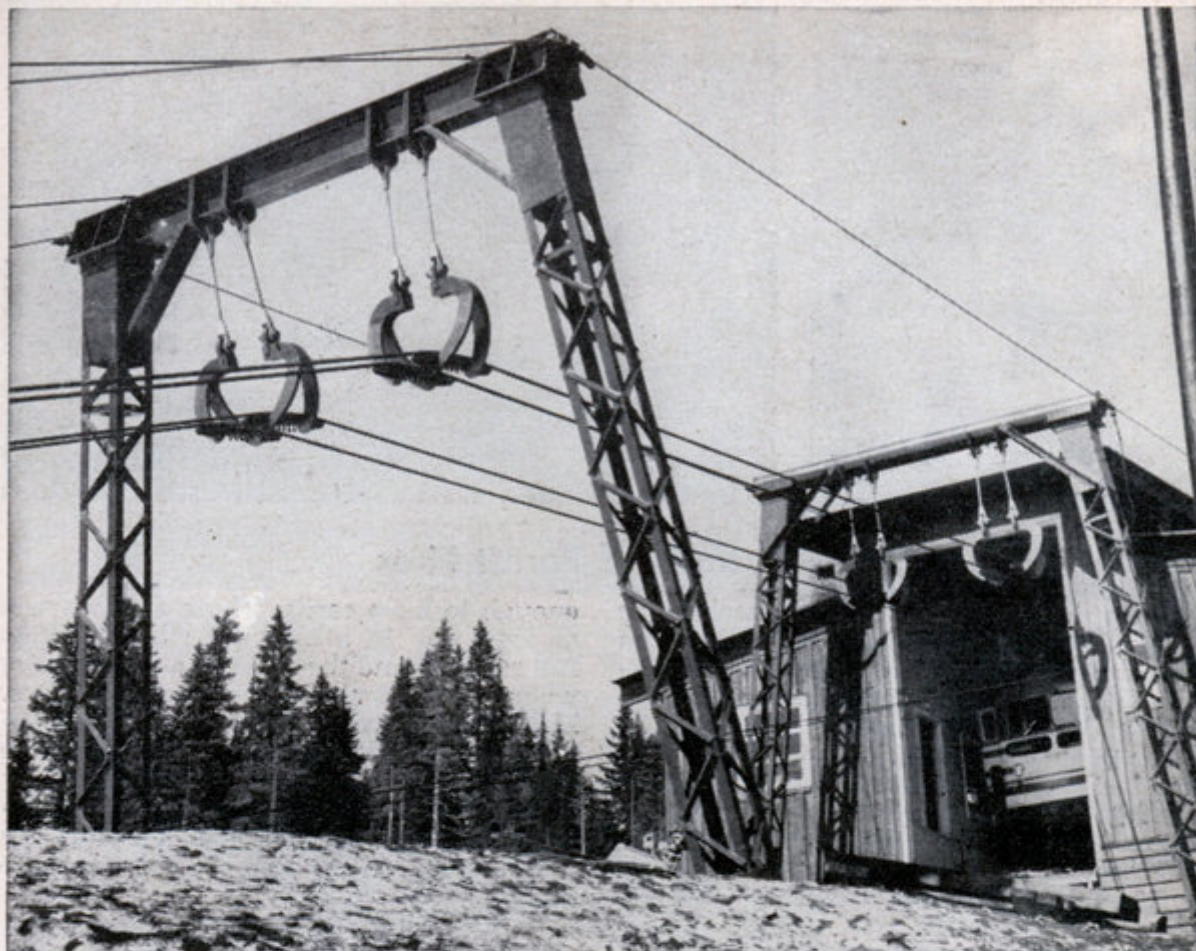
"New concepts that appear to merit investigation include mass transport of automobiles on rail 'ferries,' vehicles sup-

ported by a layer of air, and rail-guided systems that differ from conventional track," says Secretary of the Interior John T. Connor. Accompanying illustrations show examples of some of the unconventional ideas he's talking about. Thus the current program will seek to learn, not only how fast our present railroads can carry us, but what may come next.

Pneumatic tube would propel these cars

Atmospheric pressure would push trains through twin tubes in deep tunnel (upper right) at up to 325 m.p.h. when vacuum pumps exhausted air ahead of them. Wheeled cars (lower right) ride rails in tube, which floats in water serving as a cushion. Gravity helps start and brake trains at stations, in train-run sequence (far right). Underground route defies weather. This concept of Tube Transit, Inc., is brainchild of a former Lockheed engineer, Lawrence K. Edwards.



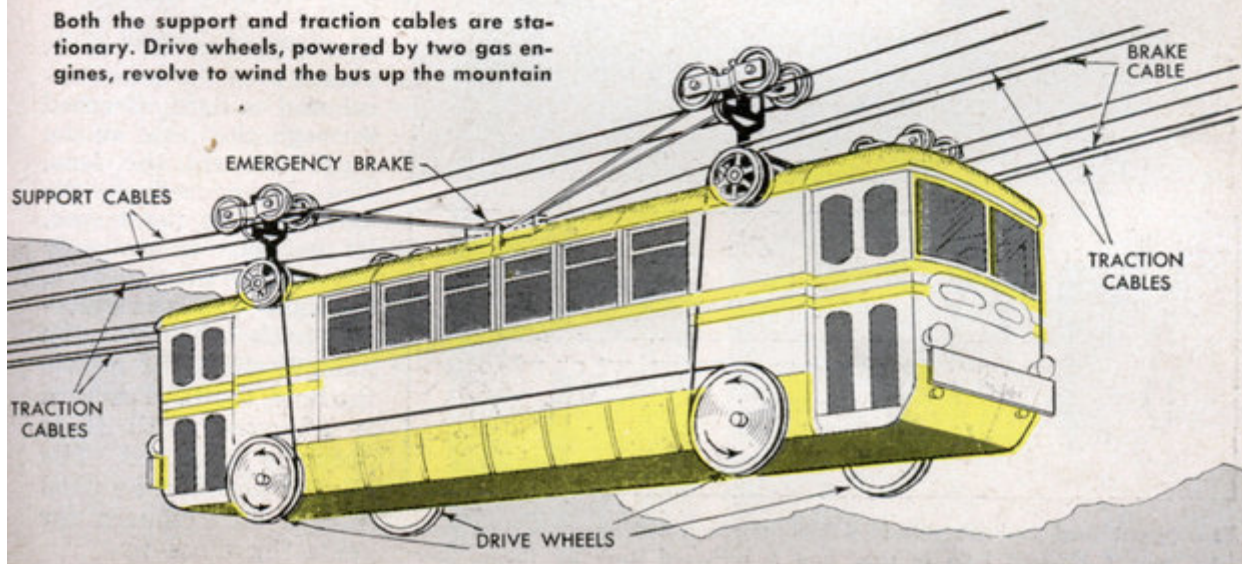


"Skyhooks" on steel towers support the aerial cables; 36-passenger bus is visible in the lower terminal

TWIN BUSES that glide high through the air will carry sightseers and skiers up the slopes of Mount Hood in Oregon during this year's winter sports season. The 36-passenger busses literally wind themselves along their cables, completing a trip of more than three miles in less than 10 minutes. Said to be the longest aerial pas-

senger lift in the world, the tramway whisks skiers from the 3800-foot level to Timberline Lodge at 6000 feet. The cables are supported by 38 A-shaped steel towers up to 72 feet tall. The traction cables wind around power pulleys on the car which are rotated by two 185-horsepower engines to carry the coaches up the mountain.

Both the support and traction cables are stationary. Drive wheels, powered by two gas engines, revolve to wind the bus up the mountain



SKY-RIDING BUS



Frank Stedworth

Sabotage!

MI
SPECIAL FEATURES

At dawn, off Frisco's Golden Gate, a Red sub surfaces and deadly germ vapor billows forth.

**Here, on the next few pages,
you will read the shocking
but all too true story of how
a little band of saboteurs,
as inconspicuous as you and I,
can paralyze the United States.**

NOW TURN THE PAGE ►

Sabotage!

By Martin Caidin

IT could happen today—tonight—without warning. An attack on our country—but not necessarily with roaring jet bombers, screaming rockets and exploding atom bombs. A crippling assault without warning could be launched against our critical cities, ports, rail centers, factories, farm belts, power stations and military objectives by one of Communism's deadliest weapons—*sabotage*.

Sabotage has always been a danger in war. It has, in fact, constituted on many occasions the opening blows of a major conflict. Until today, however, attack by subterfuge has never been more than a minor element in any great war. It has

rarely inflicted serious blows against the ability of a nation to fight.

That situation has changed. Because of the tremendous increase in the destructive power of weapons which may be transported and used against vital objectives—*by only one man or woman*—the significance of sabotage has mushroomed. It is now a weapon which is equal to many crack divisions in the field. It may become a weapon which will decide the outcome of wars.

Our own nation is particularly vulnerable to attack by sabotage. Let us suppose that the night for action has arrived. A man walks through the milling crowd at New York City's Grand Central Terminal during the evening rush hour. He carries an ordinary valise, at the bottom of which there is a small vent. An almost invisible vapor hisses out the vent, unheard in the clamor of the crowd. The vapor is laden with deadly germs; it swirls amidst the hurrying throng, is breathed in by thousands of men and women, and is transported to thousands of homes by the dispersing commuters. In La Salle Station

Exhaust pipes altered, trucks spread delayed-action death gas in our cities.



in Chicago, in other rail centers all over the U.S.A., in the jammed, milling, disease-spreading subways, on the streets—the inconspicuous men and women walk along, deadly vapor escaping from their innocent-looking suitcases.

In dozens of cities, trucks rumble through the crowded streets. They are ordinary vehicles but their exhaust pipes have been slightly altered. As the trucks roll through the cities, a vapor hisses from the false exhaust pipe and disappears among the moving people on the sidewalks. Ten miles off America's West Coast, a Russian submarine cruises beneath the surface; its periscope and a strange pipe slice unseen above the waterline. A cloud of vapor pours from the escape pipe and drifts on the warm, prevailing winds eastward over the unsuspecting land. An epidemic is on the way!

Oars muffled by padding, a rowboat glides silently across the surface of a great city reservoir. One man rows while his companion drains the contents of a plastic bag into the water. *Botulinus toxin*, 10,000 times deadlier than potassium cyanide, sinks into the reservoir of 10,000,000-gallon capacity. The men release 350 gallons of toxin in several trips—five cubic centimeters will kill a man who later drinks from the reservoir.

A janitor works late at night in the Pentagon. Unnoticed, he hurries to a broom closet, drags out a heavy cylindrical object which looks exactly like a large fire extinguisher. He stands on a desk, unhinges the grille to the main ventilation system and slides the cylinder within the shaft. He sets a battery-operated soundless timer and closes the grille. Next day, with thousands of high-ranking military officials at work, this container and many others like it pours an invisible, odorless, tasteless, deadly nerve gas throughout the vast building.

Picnickers, fishermen, hunters and tourists move unobtrusively through the great forest regions of the nation. Along their paths they drop "fountain pens." The "pens" are hidden by the grass and shrubbery of the forest belts. Hours later, a small cap explodes. Magnesium flares brilliantly. The flames spread rapidly.

In San Francisco, Los Angeles, Houston, New York, Baltimore, Boston, Washington, D. C., Pittsburgh, St. Louis, Seattle and other great industrial cities, men and women go to their closets, brush aside clothes, open panel doors and activate radio beacon sets. The aerials run to commonplace TV antennas on rooftops. Each radio



Late at night in the Pentagon, a janitor opens a grille in the ventilating system. Next day lethal nerve gas fells hundreds of top officers.

operator then leaves the city. From each set issues a distinctive radio signal. Submarines 200 miles at sea tune in to the signals, track the source and launch guided missiles with atom bomb warheads. The missiles' command systems "lock" on the beams and they hurtle unerringly to their targets.

This is war by sabotage—and sabotage with a vengeance. It is a means of attack to which the United States is particularly vulnerable.

Industrial sabotage is perhaps the most effective weapon which can be applied against America's war potential. The destruction of key factory buildings, of generator stations, the poisoning of water supplies, the dissemination of bacteriological agents, the disruption of physical communications and other means of subterfuge



Who would suspect that the harmless-looking "pen" this vacationer has dropped in the woods is a fire bomb, set to go off hours after she has left?

can help cripple, along with open enemy assault, our ability to wage war. The individual saboteur, now that atomic bombs may be transported in small, commonplace carriers, is worth his weight in ten divisions in the field.

Industrial sabotage is not necessarily exhibited through physical destruction. Panic, rumor, dissension, strife, strikes and similar activities foisted by the individual allied to the enemy's cause may be,

and have been, equally as effective.

The key to this terrible means of attack is that the saboteur is not necessarily a foreign national, or even of foreign parentage. He may be a rank amateur—a laborer, a machinist, a truck driver, a clerk, a highly-trained professional, a scientist, or the director of a large corporation. One thing, however, is almost certain: the saboteur will be the *least suspected* man or woman in a factory, a shop, or on the street.

What's the record on sabotage? It's no secret that agents of the Communist Party in this country have pinpointed every major industry for sabotage attack and have, in fact, selected the critical plants upon which a host of giant factories depend to keep operating. There are, for example, numerous aluminum plants in the United States but only a few which supply them with the necessary abrasive materials. A few key plants in our petroleum industry, knocked out, would represent a disaster to the nation's aviation fuel supplies.

During the last several years we have intercepted thousands of small booklets with sabotage instructions for Red agents in this country. In Philadelphia, we discovered a shipload of "sardine" cans, each filled with 30 to 40 tiny pamphlets listing sabotage methods, instructions and means. The sabotage methods included directions on how to destroy low and high tension electrical lines, transformers, waterfalls, sluices, dams, pipes and other key industrial equipment. Instructions were available on how to manufacture at home incendiary bottle-bombs; how to sneak home made explosive bombs beneath the beds or desks of individual personnel targets; how to mix common chemicals and sugar into hatband bombs which will rip a man's head to pieces; how to murder; how to use an ordinary pack of matches and a cigarette as a delayed-action incendiary bomb; how to cripple vital machinery with a handful of emery dust and acid; how to cut bridges and rail trusses with home-made explosives. It was an exhaustive manual on how to rip apart the productive ability of a nation behind its lines. And tens of thousands of such pamphlets have been issued to Red agents in the country, for the past 15 years!

The saboteur may not even be devoted to the enemy country, as past experience has proved. He may, of course, work for love of his homeland but he may also carry out his insidious tasks on a traitorous basis: for cash, for real or imagined hatred, for revenge. He may be under blackmail for

threats of death to loved ones in a foreign land.

With new disease agents perfected to the point where they are mass-produced, easily stored and transported over long periods of time, biological warfare by sabotage becomes a deadly possibility. BW weapons can spread disease, sickness, death and panic throughout a country. Because of the freedom of movement throughout America, and the massive quantities of goods shipped by sea, air, rail and highway, we are particularly vulnerable to BW attack. Enemy efforts would be directed against our farms and crops, with diseases and pests directed against livestock and plants.

There is one tremendous point in our favor and that is that we have the best epidemic and hygienic controls in the world. Our natural national standards of health provide a tremendous defense against biological agents. Our rapid systems of communication and transportation also mean that we can move quickly to stamp out disease outbreaks. Also, and not to be ignored, we can deal out devastating retaliation against enemy nations far more vulnerable to this type of warfare than we are.

The most active defense against BW is to

be prepared to detect quickly any new insects or foreign diseases and be ready to stamp them out at once. The better these preparations of ours to move and act quickly, the less chance the enemy will have for success in such a venture.

Attacks against America's breadbasket would most likely begin in hatcheries, stockyards, sales barns, railroad terminals, feed mixing plants and other places where large quantities of food and many animals pass through on their way to and from farms.

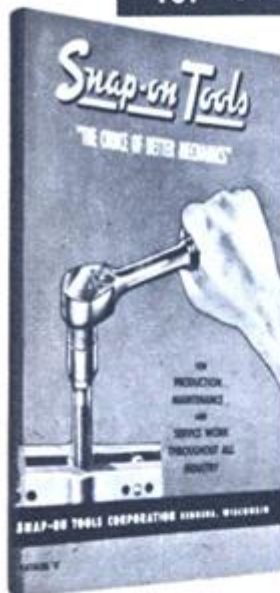
We must remember that some of the world's greatest crop and livestock blights have never been loose inside our nation. Such diseases include, among many, the Asiatic cattle plague *rinderpest* which destroys nearly every animal it strikes. Foot-and-mouth disease, often raging throughout Mexico (\$90,000,000 and years of work haven't stamped it out) is an insidious destroyer of cattle. Fowl pest and foreign strains of Newcastle disease are probably the two most destructive poultry diseases on the globe.

Foot-and-mouth disease in 1914 got a month's start accidentally in Michigan and soon spread to Chicago stockyards. It flared in 22 states before it was halted—and resulted in [Continued on page 202]

Reservoirs are a tempting target for saboteurs. Only 350 gallons of a toxin 10,000 times deadlier than potassium cyanide, will poison 10 million gallons.



send for **FREE CATALOG**



America's Foremost money-making MECHANICS' TOOLS

It's easy to own the same "pay-off" tools used and endorsed by America's top-earning mechanics throughout the automotive, aviation and industrial fields! Snap-on tools help you handle every repair job faster, easier, better. And they LAST... pay for themselves over and over again! Start building your own tool set now with basic Snap-on units—add others any time. Genuine Snap-on tools are never sold in stores—direct to users only. Mail coupon for free catalog.

Snap-on Tools
THE CHOICE OF BETTER MECHANICS

Snap-on Tools Corporation

8078-J 28th Ave., Kenosha, Wis.

Send me free catalog. Occupation _____

Name _____

Address _____

City _____

Zone _____

State _____



Custom-Craft THE ORIGINAL "PACKAGED" BOAT KITS

NOW! 55 NEW MODELS FOR 1955

World's most complete line—All types—All sizes—Plywood and new Plastic—Combo Kits—Best designs—Lowest prices! Get the facts: SEND 50c for BIG 1955 CATALOG of Kits plus boat hardware, paints, accessories, trailers and Armor-Glass. SPECIAL OFFER: Send \$1.00 for Catalog plus valuable book "Boat Selection—Operation—Maintenance." DEALERS INQUIRE!

ARMOR-GLASS

CUSTOM-CRAFT'S NEW SUPER XXX FIBREGLASS

Permanently leakproof your boat! End annual painting and caulking forever. Easy to apply to any boat. Indestructible! Hundreds of other uses.

SEND 10c for detailed folder and "How-to-Measure Form." SEND \$1.00 for folder and measuring form PLUS two valuable booklets: "How-to-Use Armor-Glass" and "How-to-Build your own Fiberglass Boat or Auto Body." Dozens of other ideas!

PATCH and REPAIR KIT: \$5 Includes generous supply of Fiberglass cloth, Super-XXX Resin PLUS plans for making Fiberglass tool or tackle box. Dozens of uses: Repairing, patching, etc. DEALER INQUIRIES INVITED.

Modern BOAT PLANS

With FULL-SIZE PAPER PATTERNS
EASIER TO BUILD, SAVES TIME, MONEY

Over 150 modern plans and patterns with material lists and building procedure. Racing classes, cruisers, inboards, outboards, sailboats, 6 to 36 ft. All materials, fittings, etc. available at "Package" prices. Big savings! Design Catalog tells all!

SEND 50c for 1955 DESIGN CATALOG
Design Catalog PLUS boat building handbook, \$1.00

CUSTOM-CRAFT • DEPT. 9 • BUFFALO 7, N. Y.

Sabotage!

[Continued from page 59]

the necessary slaughter of 172,222 animals. And we were lucky that we caught it when we did.

Asiatic Newcastle disease only two years ago slipped in by accident from Hong Kong to a California fowl establishment. We were extremely fortunate to discover the disease at once. But not before 41 of the 42 chickens on the farm were killed.

Government experts admit there are hundreds of crop pests and diseases which have never reached our shores and which could wreak disastrous havoc. They could be smuggled easily across our borders, dropped from enemy planes or sown by hand, and they could blight our crops with rusts, scales and other effects.

A few men—one man—with a few vials of wheat rust like the new 15B conceivably could scatter amounts from Mexico to Canada, and within a year or two the nation would be suffering from a raging scourge across the Great Plains.

Possibly the greatest danger from BW when used against people—against you—is mental: the generation of rumor and subsequent panic. Because many of the BW agents which may be used against us are of a foreign, strange nature, their apparent effects could touch off wildfire panic. There are no really new diseases among biological agents; old diseases have been made more dangerous, and diseases strange to our shores may be used. But medical facilities, despite initial outbreaks, stand an excellent chance of combatting such scourges if the public refuses to panic and cooperate with health authorities.

If the enemy can cause panic, by spreading wild rumors regarding BW agents, and can cause our people to flee from their cities, he is just as successful in his efforts as if he had actually destroyed thousands of factories. The basic goal of war against a nation's homeland is not to destroy factories—it is to destroy production. And that can be accomplished by wholesale desertion of the production line as well as by atomic attack.

Fortunately, there are defenses against sabotage of all kinds. We can, by intelligent thinking and action now, reduce by a great margin the possible success of saboteurs. Guards can be placed on 24-hour patrol of our reservoirs (as they have been done in some cases) to protect our drinking water supplies against contamination by disease and poisons. We can install filter traps to test our water on a 24-hour basis.

A security system can be established to protect vital rail bridges, mountain cuts and

Wanted—Ten Billion—

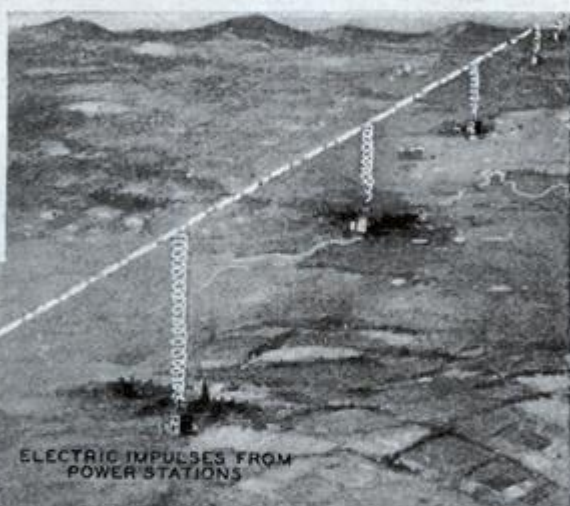
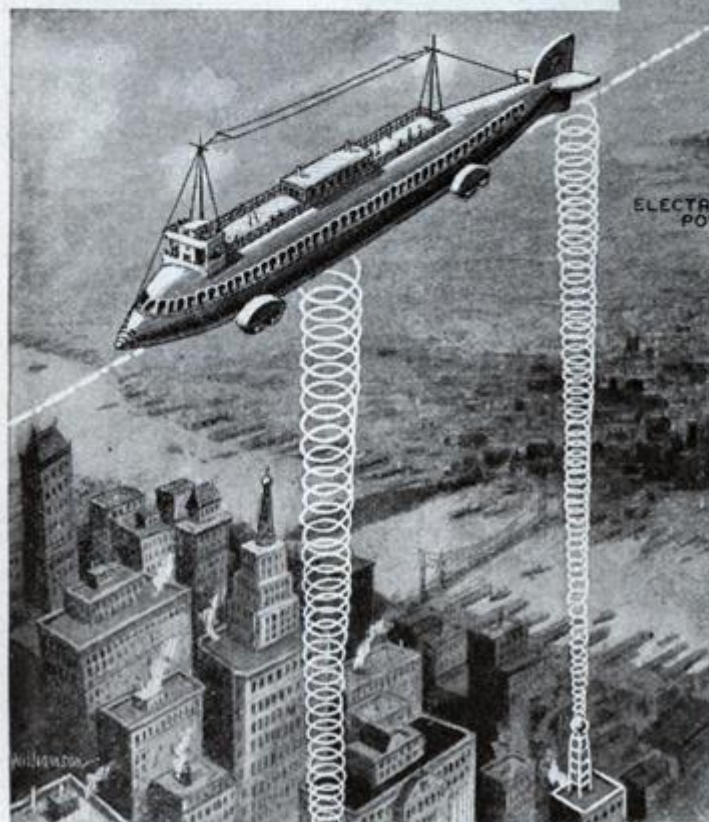
by RAYMOND FRANCIS YATES

What are the inventions of tomorrow which will be worth billions of dollars to industry? Mr. Yates, member of the Institute of Radio Engineers and well-known writer on scientific subjects, here describes ten billion-dollar ideas. It will be interesting to make your own list and compare it with that of Mr. Yates.

THERE is at hand a new day of big rewards for inventors; rewards larger than dared to be dreamed of years ago. America is particularly anxious to stimulate its genius by the payment of huge sums of money to those who can solve the industrial problems that many of our large manufacturers are now facing. It has been said that competition is life of trade; it is more than that, it is the life of invention too. It has caused many of our great industries to establish their own laboratories in an attempt to better their products and widen their markets.

America needs more inventions today

than it ever needed before and thousands of professional inventors have been hired to find these new things; these market builders. However, this, contrary to current opinion, does not mean that the independent inventor is no longer a factor or that his efforts are no longer needed. The



Electro-magnetic levitation, in which passenger cars are supported above the earth by electric impulses, is a billion-dollar transportation idea. Perfection of television likewise falls into the billion-dollar class.

Dollar INVENTIONS

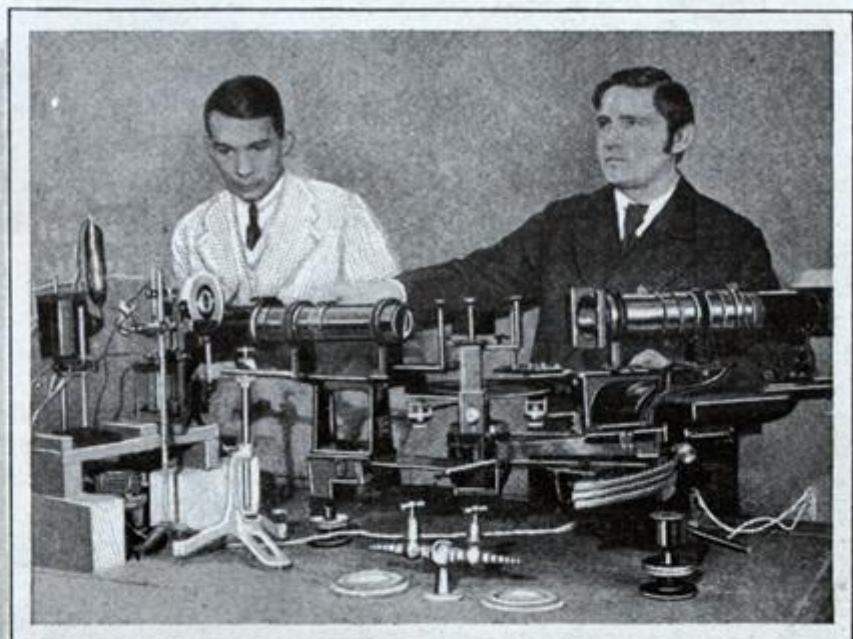


The direct conversion of heat into electric energy will be worth a billion dollars to industry. With the perfection of this idea, it would be possible to turn the heat of the sun into electric current—a feat which is possible today, but not practical commercially.

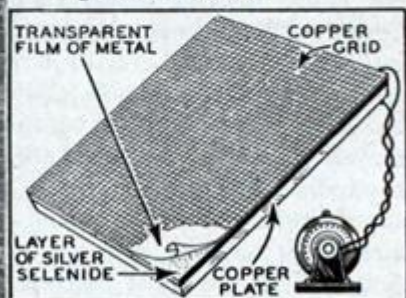
records of the patent office prove quite the opposite. Manufacturers want ideas and they don't care where they come from. The fact that many of them have established their own laboratories just goes to show how tightly pressed they have been; how keenly they feel the onslaught of competition.

A short time ago the writer sat in the lounge room of a club. Two chemists, an electrical engineer, a mechanical engineer and a business man were present. The conversation drifted to invention and research and the business man finally asked those

Inventions for September



At right above is Dr. Bruno Lange, German scientist who has succeeded in producing current from sunlight, in the manner diagrammed below.

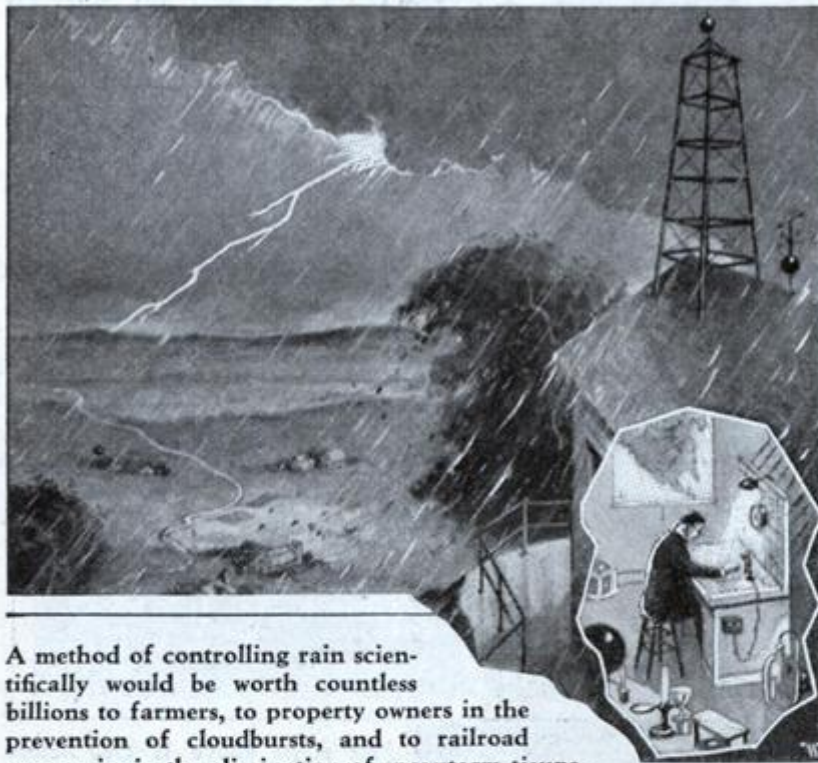


Two metal plates, separated by a layer of silver selenide, produce an electric current when exposed to the heat of the sun.

present to name what they thought were the outstanding problems of the day; to name what he was pleased to call "ten one-billion dollar ideas". At first there was some dissension but as the conversation wore on, agreement was at last reached and ten problems really in the billion-dollar class were laid down. It was not thought that inventors would receive this amount for their ideas. Rather, it was merely believed that the successful solution of the problems would be worth a billion dollars each to the industry to which they were related.

The first problem discussed had to do

Industry and Farmers Need Device to Control Rainfall Scientifically



A method of controlling rain scientifically would be worth countless billions to farmers, to property owners in the prevention of cloudbursts, and to railroad companies in the elimination of snowstorm tieups.

with a new source of power. Atomic energy was ruled out as being visionary and at present utterly beyond control, even if it could be produced. Also a substitute for gasoline was ruled out. Such substitutes are known but they have not as yet destroyed our gasoline markets nor do they jeopardize the millions that our gasoline manufacturers have invested in their refineries. It was decided, however, that electricity offers the most convenient, the most reliable and the most flexible means of power. What is needed is a cheap and effective means of storing large quantities of electricity in small light weight containers. Let us assume that a storage battery of new type is invented that will deliver a power of 25 horses for a period of 48 hours. What would this mean to transportation? What would this mean eventually to our gasoline market? In place of taking on ten gallons of gasoline at the gas station, we would simply take on a new container of electricity. During the night, when the service load on the public utility mains was relieved, current could be used to recharge such containers. Even such great water falls as Niagara might be "turned off" during the night and the power generated (some 7,000,000 horsepower) be

used in this manner.

The electric automobile would be the ideal. Silent, fast and with a flexibility that can never be hoped to be reached in the gas car. Not only that, but it would be free of gas and it would require only an insignificant percentage of the lubrication needed for the gas machine. Surely that would be a billion dollar idea, and conservatively rated at that.

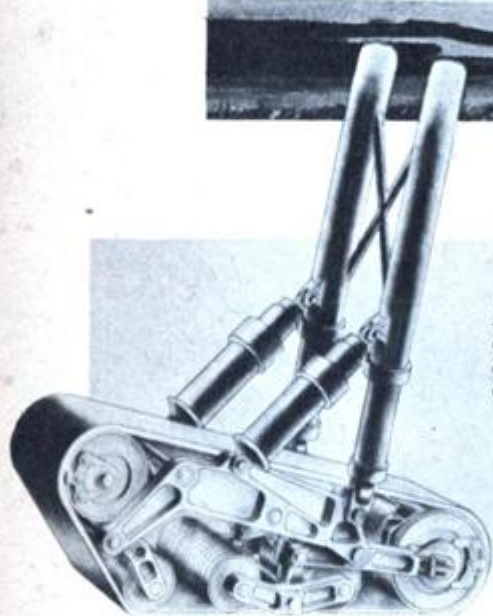
The discussion of this idea suggested the second billion dollar invention; the direct conversion of the heat from coal and other fuels into electric energy. At the present time, we burn coal, produce steam and permit the steam to expand in either a turbine or a steam engine.

This is a very wasteful process and one that costs us many billions of dollars annually. It has been known for many years that when two dissimilar metals are brought together and heated at the points of their juncture, a small electric current is produced. On this principle a thermo-electric battery has been produced, but what we need is a thermo-electric generator of large size where the heat produced by the burning coal will be directly converted into electricity. By this process, at least fifty per cent more energy could be derived from the same amount of coal. And this aside from the advantage of junking almost half of the equipment now needed to produce power. To say that this is a billion-dollar idea is surely leaning toward conservatism.

A flying machine that will be able to operate vertically and horizontally is a much needed idea. True, we have the helicopter, but in its present form it by no means offers a solution to the problem. It is really a makeshift and but a passing fancy of designers. It can never endure. It is simply an airplane with two propellers.

When problems of invention and research are discussed, there always appears that old but none the less interesting sub-

Air Freighters Have New Feet



Above: Fairchild C-82 Packet equipped with tractor type landing gear shown in detail in closeups. Gear permits soft surface landings.



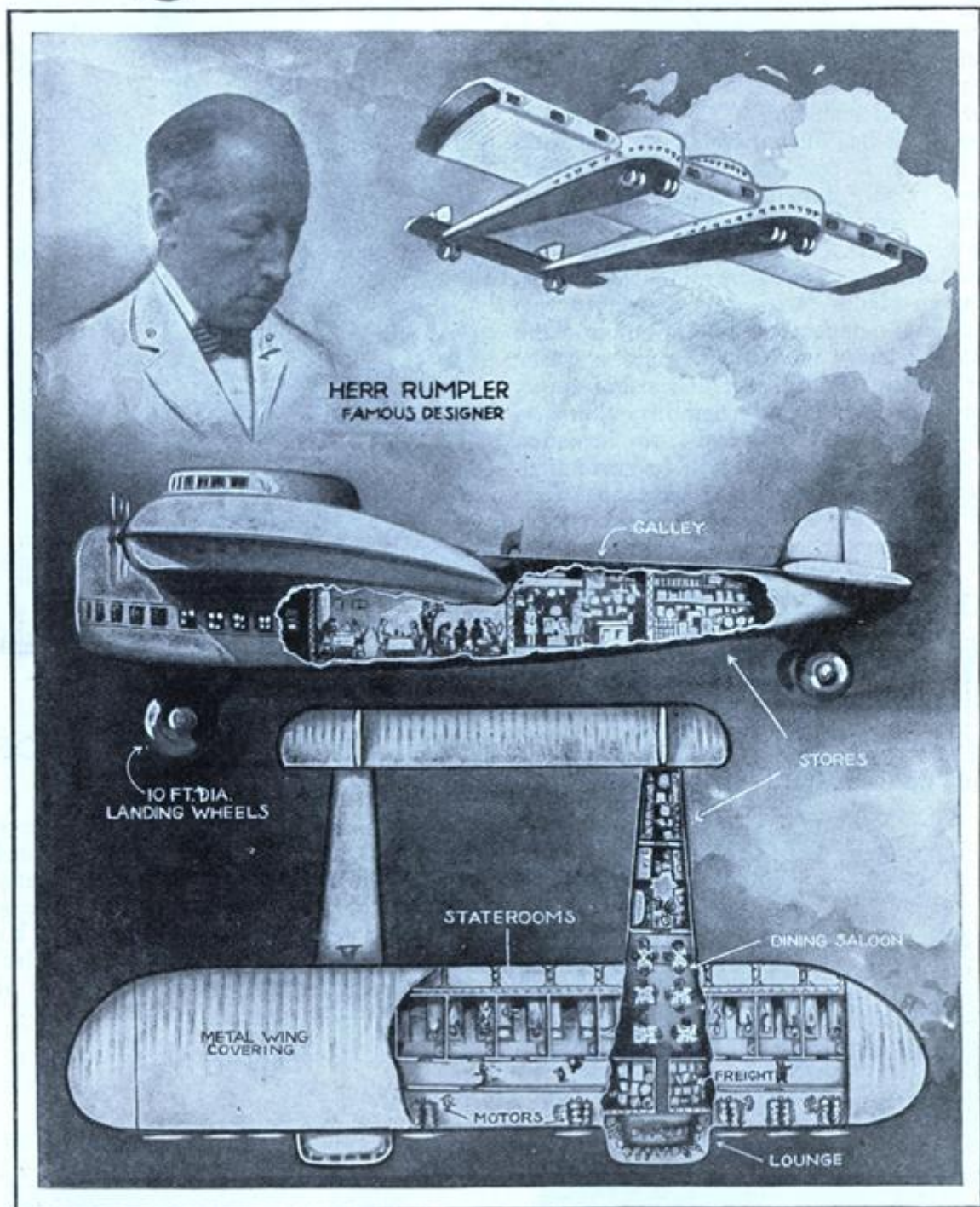
Here the gear is installed on an A-20 Havoc which underwent successful tests.



THIS new tractor type landing gear, now undergoing tests at Air Material Command headquarters, Wright Field, Ohio, is designed to enable heavy planes to land on runways which are not concrete-covered. The gear, which is similar to that used on tanks and was developed by the Firestone Rubber Co., was originated by the AMC early in the war. In present tests on heavy cargo planes, a rubber-wire cord combination has been found most efficient. Attempts are being made to develop a light-weight gear. •

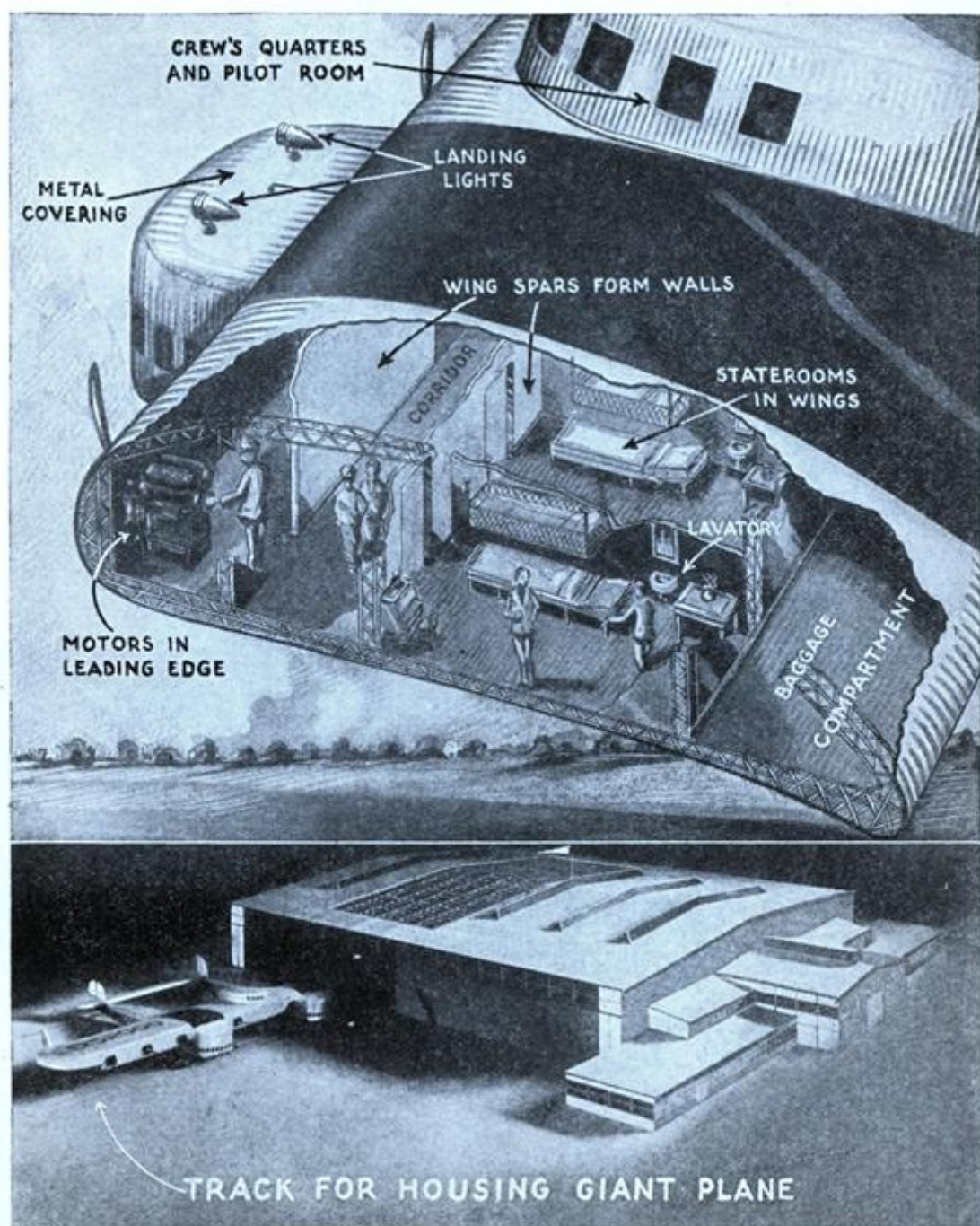
Mechanix Illustrated

RUMPLER Designs

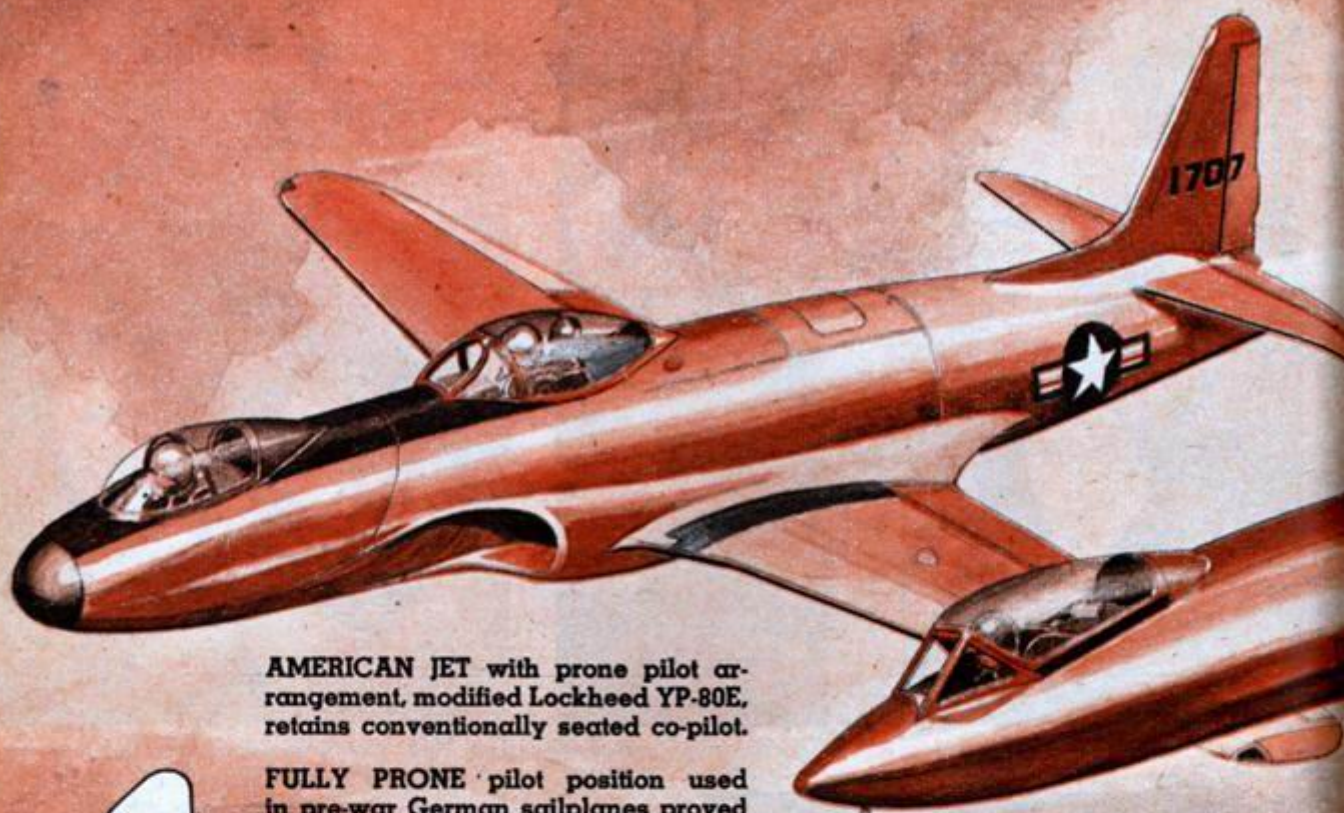


Herr Rumpler, famous designer of Germany's war time fighting planes, is turning his peace time activities to good account in developing the world's largest airplanes. Rumpler, shown above in a characteristic pose at his drafting board, is now building an enormous monoplane which will have wings large enough to place staterooms in. A new blunt-nosed wing section is used to effect this design. Huge wheels, 10 feet in diameter, will be used on the landing gear. All motors will be easily accessible in flight. Navigating quarters will be in a cabin atop the wing.

Largest PLANE



The new Rumpler monoplane, now nearing completion in Germany, will have a span of 300 feet and a chord of 50 feet. It will be so large that space between the sides of each wing spar will be used for hallways, staterooms and motor compartments. A specially designed, power operated air field railway track will be constructed for housing the new giant. The cross section drawing shows the disposition of the arrangement. The plane will cruise at 82 m. p. h. A gigantic hangar is shown in the photo below with the big ship on the track. Note room for two of these monsters.



AMERICAN JET with prone pilot arrangement, modified Lockheed YP-80E, retains conventionally seated co-pilot.

FULLY PRONE pilot position used in pre-war German sailplanes proved to be a highly successful concept.



SEMI-PRONE position was used in an all-wing German sailplane (Horten IV) back in the 1930's.



CLEARANCE for semi-prone pilot is 30" against 42" for the seated pilot.

Fighter pilots of tomorrow may fly the same way their aircraft do—nose foremost.

By Douglas Rolfe



BRITISH JET, the long-nosed Gloster Meteor Eight, as it appears in flight after modification for control by a pilot in prone position.

AUTHOR'S CONCEPT of small jet fighter includes pressurized prone pilot ejection pod.

DOUGLAS
ROLFE

Flying Down On The Job

THE first airplane to get off the ground back in 1903 was flown by a prone pilot. Originated by the Wright Brothers, the prone pilot position was soon abandoned in favor of the upright seat and was to all intents and purposes a dead issue until the mid-30's.

Then the Germans revived the idea in their search for better sailplane per-

formance. During the second World War the Germans again experimented with the prone pilot position—this time in some of the jet fighters they were developing and demonstrating to an astonished world. They also experimented with the supine position in which the pilot lies on his back—but that's another story.

[Continued on page 184]



Men, chemistry, and coal!

Science has found a new way to get valuable chemicals from coal

Coal has long been one of man's most useful servants. Now it holds promise of even greater benefits to all of us.

COAL INTO CHEMICALS—Science has at last found a practical way to convert coal into the host of valuable chemicals that nature locked into it.

The people of Union Carbide have developed a way to bring coal and hydrogen gas together under carefully controlled heat and pressure. In minutes, this revolutionary process—called *coal hydrogenation*—converts the coal into a mixture of gases and liquids that are rich in useful chemicals.

A WEALTH OF RAW MATERIALS—Among them are hitherto scarce, and even completely new, chemicals. Some are raw materials for plastics and synthetic rubber, or are vital to medicine and vitamins. Some are valuable in rocket propulsion. Others are necessary in insecticides, surface coatings, and many other important uses.

A NEW SOURCE OF SUPPLY—Today, Union Carbide's coal-hydrogenation process promises steady and vastly increased production of chemicals for these needed materials. What's more, it will provide a host of chemicals that may become the basis of many new products.

A UCC ACHIEVEMENT—With the first coal-to-chemicals plant of its kind in operation, the people of Union Carbide are now well on the way to making abundant coal a source of chemicals important to us all.

FREE: If you would like to learn more about Union Carbide's exciting new coal-hydrogenation process, write for the illustrated booklet, "Chemicals from Coal." Ask for booklet A.

UNION CARBIDE
AND CARBON CORPORATION
30 EAST 42ND STREET  NEW YORK 17, N. Y.

UCC's Trade-marked Products of Alloys, Carbons, Chemicals, Gases, and Plastics include

SYNTHETIC ORGANIC CHEMICALS • BAKELITE, KRENE, and VINYLITE Plastics • LINDE Oxygen • DYNEL TEXTILE FIBERS
ELECTROMET Alloys and Metals • HAYNES STELLITE Alloys • PREST-O-LITE Acetylene • PYROFAX Gas
EVEREADY Flashlights and Batteries • NATIONAL Carbons • ACHESON Electrodes • PRESTONE and TREK Anti-Freezes



Reaching for the moon

Once it meant the impossible...

today it's a progress report on scientific research

WHO DARES call anything impossible today? Not when research scientists are constantly seeking and finding new wonders to improve the way you live.

ONLY A DREAM YESTERDAY... reality today. A generation ago, Union Carbide scientists began taking oil and natural gas apart and putting the pieces together again in ways unknown to nature.

The result? A steady stream of entirely new chemicals... an average of one a month for the past 25 years. The benefits of these petroleum chemicals are everywhere—man-made textile fibers, amazing plastics, life-saving wonder drugs, enduring paints and enamels... the list is endless.

NOT ONLY CHEMISTRY has felt the touch of Union Carbide research. Alloying metals that make possible

stainless and other fine steels, oxygen from the air for medical and industrial use, a variety of carbon products—all have been developed, made better or more abundant through UCC research.

AND THE MOON? The work of Union Carbide scientists in new metals such as titanium, in rocket fuels, and in the beneficial uses of atomic energy, is helping man reach in that direction, too.

FREE: Learn how *ALLOYS, CARBONS, GASES, CHEMICALS, and PLASTICS* improve many things that you use. Ask for "Products and Processes" booklet.

UNION CARBIDE

AND CARBON CORPORATION

30 EAST 42ND STREET  NEW YORK 17, N. Y.

In Canada: UNION CARBIDE CANADA LIMITED, TORONTO

UCC's Trade-marked Products include

SYNTHETIC ORGANIC CHEMICALS

PRESTONE Anti-Freeze

EVEREADY Flashlights and Batteries

PREST-O-LITE Acetylene

Dynel Textile Fibers

ELECTROMET Alloys and Metals

HAYNES STELLITE Alloys

UNION Carbide

LINDE Oxygen

LINDE Silicones

BAKELITE, VINYLITE, and KRENE Plastics

NATIONAL Carbons

ACHESON Electrodes

PYROFAX Gas



Promise of a golden future

Yellow uranium ore from the Colorado Plateau

is helping to bring atomic wonders to you

Long ago, Indian braves made their war paint from the colorful sandstones of the Colorado Plateau.

THEY USED URANIUM—Their brilliant yellows came from carnotite, the important uranium-bearing mineral. Early in this century, this ore supplied radium for the famous scientists, Marie and Pierre Curie, and later vanadium for special alloys and steels.

Today, this Plateau—stretching over parts of Colorado, Utah, New Mexico, and Arizona—is our chief domestic source of uranium. Here, new communities thrive; jeeps and airplanes replace the burro; Geiger counters supplant the divining rod and miner's hunch.

From hundreds of mines that are often just small tunnels in the hills, carnotite is hauled to processing mills. After the vanadium is extracted, the uranium, concentrated in the form of "yellow-cake," is shipped to atomic energy plants.

A NEW ERA BECKONS—What does atomic energy promise for you? Already radioactive isotopes are working won-

ders in medicine, industry, and agriculture. In atomic energy, scientists also see a vision of unknown power—which someday may heat and light your home, and propel submarines, ships, and aircraft. The Indian's war paint is on the march again—toward a golden future.

UCC TAKES AN IMPORTANT PART—The people of Union Carbide locate, mine, and refine uranium ore. They also operate for the Government the huge atomic materials plants at Oak Ridge, Tenn., and Paducah, Ky., and the Oak Ridge National Laboratory, where radioisotopes are made.

FREE: For an illustrated story of the fascinating uranium country of the Colorado Plateau, write for the booklet "Mesa Miracle." Ask for booklet B.

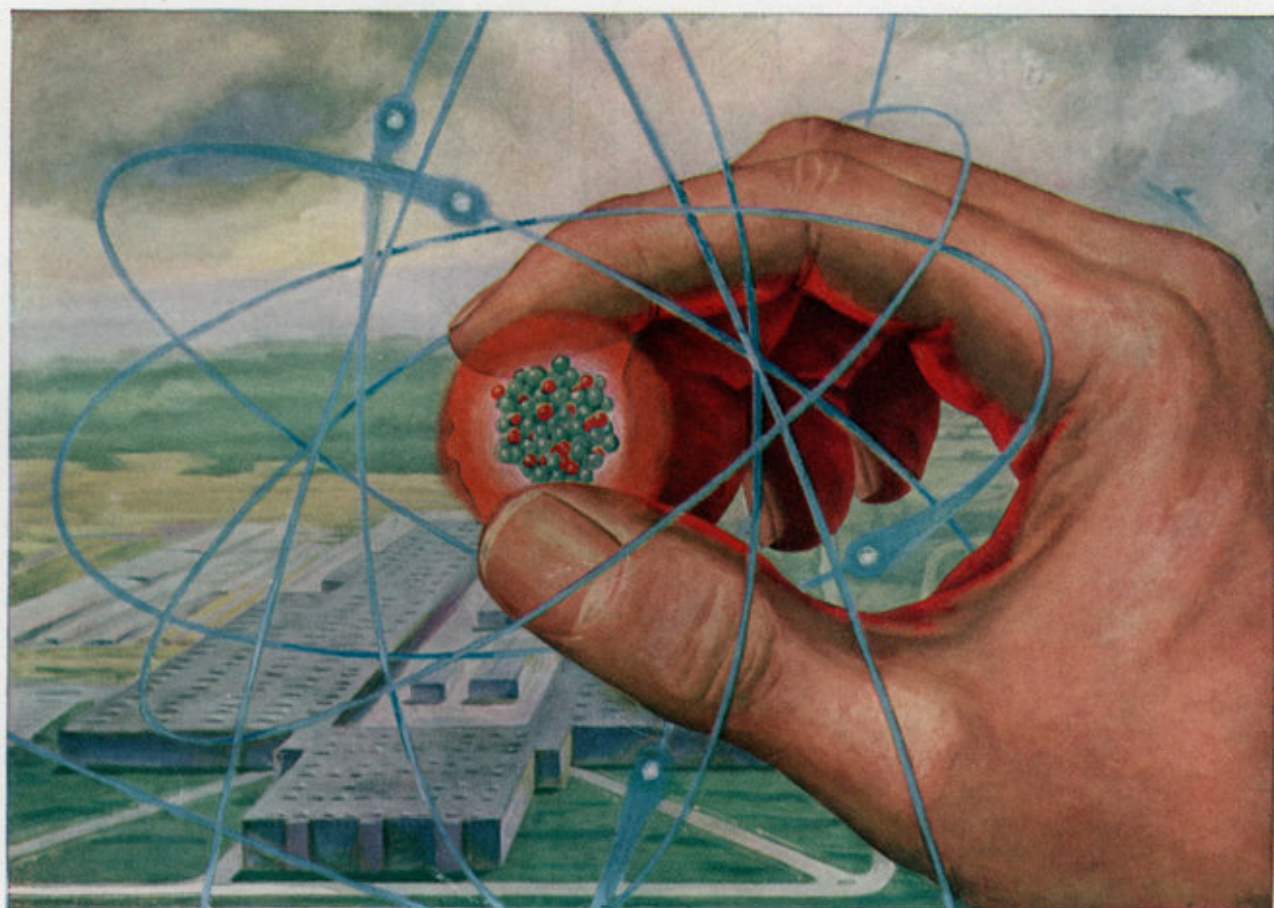
UNION CARBIDE

AND CARBON CORPORATION

30 EAST 42ND STREET  NEW YORK 17, N. Y.

UCC's Trade-marked Products of Alloys, Carbons, Chemicals, Gases, and Plastics include—

ELECTROMET Alloys and Metals • HAYNES STELLITE Alloys • EVEREADY Flashlights and Batteries • NATIONAL Carbons
ACHESON Electrodes • PYROFAX Gas • PRESTONE and TREK Anti-Freezes • PREST-O-LITE Acetylene
BAKELITE, KRENE, and VINYLITE Plastics • DYNEL TEXTILE FIBERS • LINDE Oxygen • SYNTHETIC ORGANIC CHEMICALS



What does Atomic Energy really mean to you?

Dramatic new developments in medicine, agriculture, and industry promise long-time benefits for us all

Scientists have long known that the secret core of the atom concealed vast stores of concentrated energy. Evidence that man had unlocked the secret came with the atomic bomb.

Then came the task of developing methods to release this unbounded energy slowly, gradually, in ways of lasting benefit to all of us.

ISOTOPES AN EXAMPLE—When uranium atoms are split they emit a barrage of highly active particles. Certain chemicals placed in this barrage become radioactive and shoot off particles from themselves. Substances thus treated are called radioactive isotopes.

When these chemicals are made radioactive their paths can be traced through plants and animals, showing the organs they affect. This may increase our understanding of the processes of life itself.

FUTURE UNLIMITED—Atomic energy is also proving useful in industrial research and production. It promises to be even more valuable, however, in providing concentrated power for transportation, home, and industry.

UNION CARBIDE'S PART—From the beginning UCC has had a hand in the mining and treatment of uranium ores, the development of engineering processes, and the production of special materials for the atomic energy program. Under Government contract Union Carbide manages and operates the huge research and production installations at Oak Ridge, Tenn. and Paducah, Ky.

All of this activity fits in with the continuing efforts of the people of Union Carbide to transform the elements of the earth into useful materials for science and industry.

FREE: Learn more about the interesting things you use every day. Write for the 1953 edition of "Products and Processes" which tells how science and industry use the ALLOYS, CARBONS, CHEMICALS, GASES, and PLASTICS made by Union Carbide. Ask for booklet D.

UNION CARBIDE
AND CARBON CORPORATION
30 EAST 42ND STREET **UCC** NEW YORK 17, N. Y.

UCC's Trade-marked Products of Alloys, Carbons, Chemicals, Gases, and Plastics include

SYNTHETIC ORGANIC CHEMICALS • EVEREADY Flashlights and Batteries • NATIONAL Carbons • ACHESON Electrodes • PYROFAX Gas
ELECTROMET Alloys and Metals • HAYNES STELLITE Alloys • PREST-O-LITE Acetylene
DYNEL TEXTILE FIBERS • BAKELITE, KRENE, and VINYLITE Plastics • LINDE Oxygen • PRESTONE and TREK Anti-Freezes



Details on the NX2—Our

OUR long-awaited atomic-powered airplane—Convair's Model NX2—is finally on the drawing boards, its components in various stages of construction and testing.

After 14 years' research and an investment of close to 1 billion dollars, the plane's reactor is under test and two different engine systems, both slated for early flight testing, are in advanced development.

What will take to the air sometime in 1964 over sparsely populated western terrain and along 50-mile-wide "radiation corridors" promises some surprises for old-hand plane watchers.

America's "hottest" bomber, big as a B-52, will have swept back wings and non-orthodox tail control surfaces. Although the NX2's vital statistics are still shrouded in secrecy, the ship soon to be constructed at Convair's plant in Fort Worth, Texas, will measure some 180 ft. from nose to tail and have a wingspan of about 150 ft. Its wings will carry no engines except for two conventional jet

When will our "hottest" bomber take to the skies? How will it perform? What about the radiation danger? Here are the answers

By JAMES JOSEPH

boosters planned for experimental flights only (Fig. 5). Thus the plane will have thinner and broader wings than the B-52 to balance its tail-heavy reactor and radiation shielding. Control surfaces on the vertical and horizontal stabilizers will be smaller than for jet planes of comparable size. This is because the plane's center of gravity won't shift as it does on jet planes as they consume fuel. One pound of fuel probably will carry the NX2 about 14,000 miles and keep it aloft for 24 hours or more.

Reactor Is Heart. A shielded, spherical re-



This photo shows a model of the NX2 atomic-powered airplane and part of its ground support equipment. Design serves the double purpose of protecting control surfaces from jet blast and isolating the crew from the reactor.

Atomic Plane

actor, heart of the NX2, will contain uranium 235 or plutonium 239, both easily fissionable materials, as fuel. The reactor—and there's a possibility that there may be two of them—acts as the source of the heated air that provides thrust.

A single gram (or about 0.035 lbs.) of reactor fuel generates about 1 million watts during a day's fissioning and boosts the reactor's temperature well above 1,200 F.

Capt. Thomas L. Jackson, an Air Force nuclear technologist, has estimated that to power a nuclear bomber at near the speed of sound and to altitudes of 35,000 ft., a reactor must supply "in the neighborhood of 300 mgw."

A view of the complex test stand for GE's atomic engine test at Arco, Idaho. Reactor and engines shown in Fig. 4 were built on a railcar that was then rolled into the radiation-proof test room shown in Fig. 6.

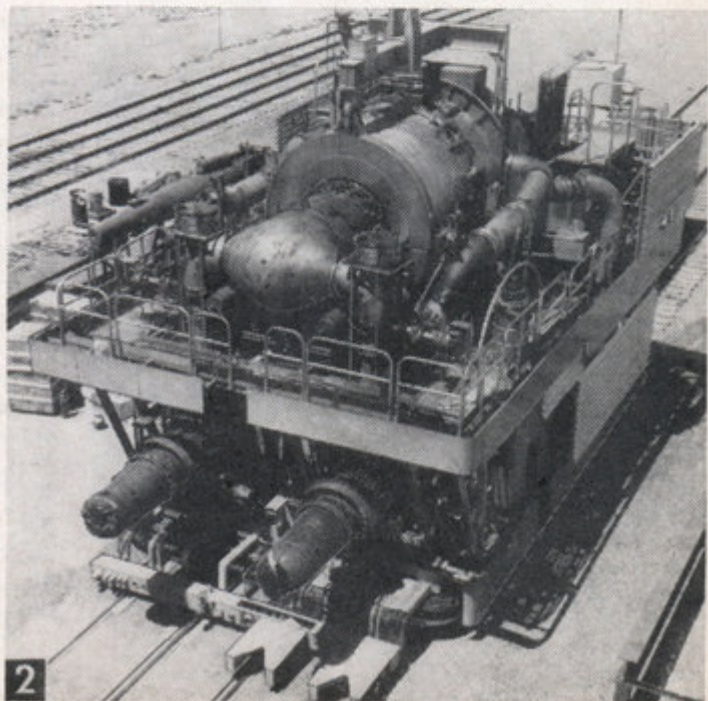
While this figures out to about 0.65 lbs. of atomic fuel a day, actually the "fast" reactor under development for NX2 is said to be far more efficient. A dwarf compared to ordinary power reactors, it nevertheless squeezes far greater power from a gram of reactor fuel.

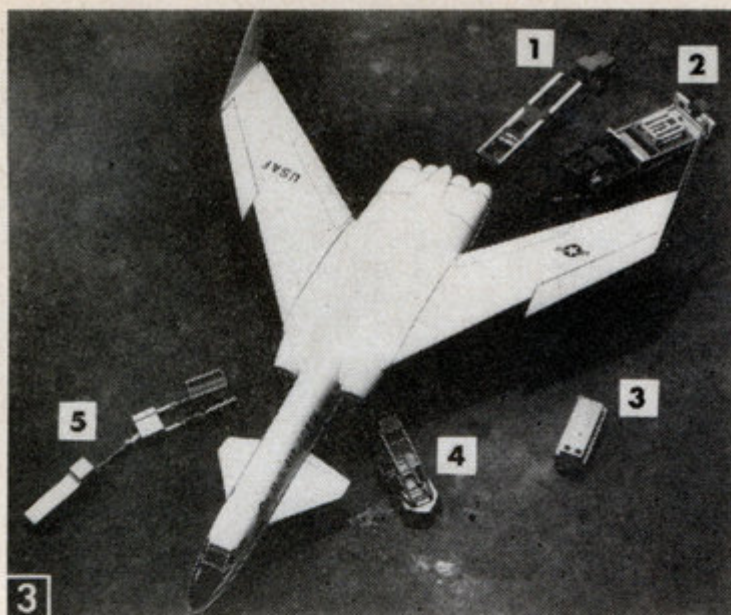
Fast reactors differ from bigger, less volatile reactors in that they usually contain neither control rods nor moderators (see p. 93, Aug. '60 S&M).

In the absence of control rods, fission is regulated by moving the fuel elements or reflector segments in the reactor's core to increase or decrease the number of neutrons and thus the rate of fission. One nuclear technician suggests that NX2's fast reactor may be controlled by a rotatable drum, coated on one side with boron, an element that captures neutrons. Controlled from the cabin, the drum's boron side can be rotated to absorb neutrons and thus slow or stop the fission process.

Two Possible Power Systems. While NX2's reactor is under test at the AEC National Reactor Test Station, Arco, Idaho, two jet engine systems are in advanced development.

General Electric's direct cycle power plant sucks air directly through the reactor's radioactive core (Fig. 4). Piped to the jet engines, the superheated and compressed air expands violently. Blasting from exhaust ducts, it drives the ship forward.





This view of the NX2's ground support vehicles shows (1) cowl handler; (2) power plant handler; (3) aftercooling vehicle used to remove residual reactor heat; (4) utility vehicle that provides a movable shielded cab for ground operations, and (5) a payload-handling vehicle being moved by a shielded tow vehicle. This tow vehicle will also be used for moving the airplane with the reactor aboard.

Pratt & Whitney's indirect cycle system taps reactor heat indirectly through a closed loop that circulates liquid metal from the reactor's core to heat exchangers where compressed air is heated and turned into thrust.

Direct cycle advocates claim the system is the simplest, most reliable and easiest to maintain.

Other nuclear engineers are not so convinced.

"The direct system's inherent limitations rule it out as a really high-performance supersonic power plant," says one engineer.

These limitations stem from the fact that air, being a poor conductor of heat, can seldom tap a reactor's full potential. If it can, the reactor must be big enough to present a large heat transfer area to the airstream. Jet engine air also runs the risk of nuclear contamination through contact with reactor fuels.

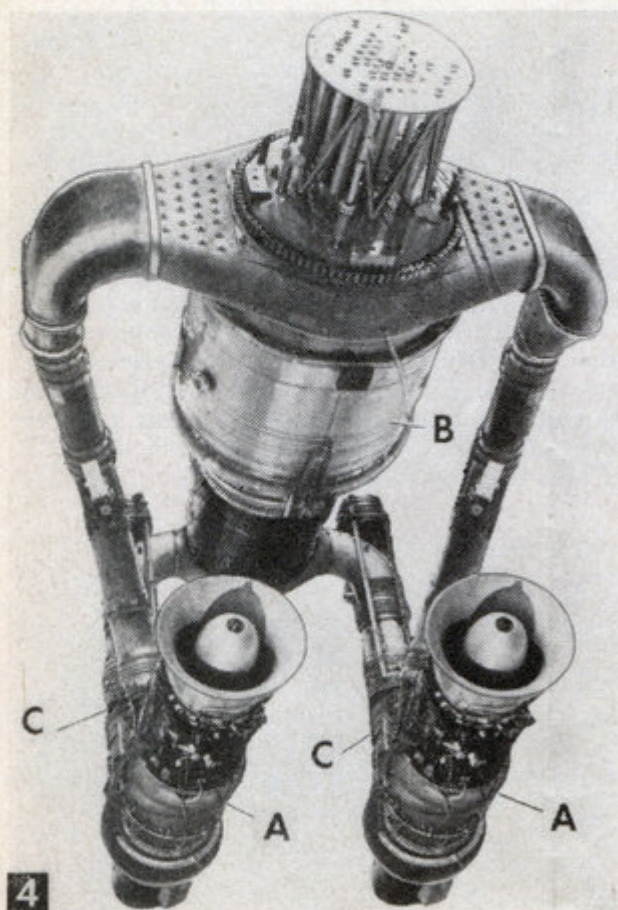
The indirect cycle system has several advantages. Liquid metal, the most efficient heat conductor known, can remove essentially all the heat from even the smallest, most compact reactor. Unlike a direct cycle system, the reactor and its fuel elements can be isolated against oxidation. Jetstream contamination is virtually impossible.

But there are some disadvantages. The indirect system involves a complex of piping and plumbing, including liquid-metal circulating pumps operated by engine air, that sap some of the turbojet's thrust. Piping is prone to leaks, and a reactor left uncooled can explode. Remote plumbing requires shielding not necessary in the direct cycle system.

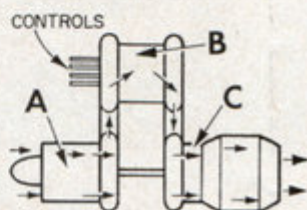
However, both systems pose one of the thorniest problems to confront designers of advanced aircraft reactors (the only type that can generate enough power to propel planes at supersonic speeds): where to find materials that can withstand the tremendous reactor temperatures in the 3,000 F° range.

A mixture of heat-resisting ceramics and reactor metals called *cermets* may help solve the problem, say some engineers. Among the refractory cermets now being developed for aircraft fast reactors are beryllium oxide, beryllium carbide and graphite compounds.

Shielding Problems. The joint AEC-Air Force Aircraft Nuclear Propulsion (ANP) program has both civilian and military re-



Basic components in General Electric's direct cycle system. The two modified GE J-47 turbo-jet engines (A) pull air into their compressors before routing it to the reactor (B). After flowing through the reactor, where it is heated, the air is piped back to the engines' turbine stages (C).



An artist's conception of NX2 design showing conventional jet boosters—planned as a safety precaution for experimental flights.

search teams studying the problems involved in flying a "hot" plane.

These ANP researchers, deployed at a dozen strategic nuclear test centers coast to coast, are currently at work on these problems:

- How to devise relatively lightweight shields that effectively stop gamma rays, the deadliest of radiation rays. One solution lies in using alternate layers of neutron and gamma shielding. A layer of lead stops gamma rays and a liquid layer of borate solution blocks neutrons.

- How, in the face of radiation damage, to prevent NX2's reactor from melting and adjacent aircraft parts from falling to pieces. Under "slow neutron" bombardment, many common metals completely change their form. Aluminum becomes silicon; copper turns to nickel and zinc. Shielding the components near the reactor with such radiation-thwarting metals as beryllium may offer one solution.

- How to lengthen the life span of other common aircraft materials. When irradiated, high-strength metals become brittle and weak, rubber loses its elasticity, lubricants become gaseous and gummy. Hundreds of radiation-stable materials are now being developed.

There also are problems in shielding the crew. Although they must work, sleep and eat together for a period up to five days, every cubic foot of cabin space means anywhere from 50 to 500 lbs. of shielding. Lop off a cubic foot and shielding and weight are reduced. Designers have no choice but to miniaturize.

"Of course, an atomic plane's reactor *could* be completely shielded against the least radiation leak," says Andrew Kalitinsky, head of Convair's nuclear department.

"But to shield a reactor completely," he continues, "you would end up with a much heavier shield, and a much heavier airplane, for the same engine power and thrust. The performance of such an airplane would obviously not be as good."

So designers have compromised by using divided shielding (Fig. 8). Some shielding rings the cabin, and some is distributed throughout the ship to protect such components as electric conduits, lube lines and vulnerable instruments. The cabin will have complete protection.

It's when the A-plane lands that the difference between this aerial giant and non-atomic

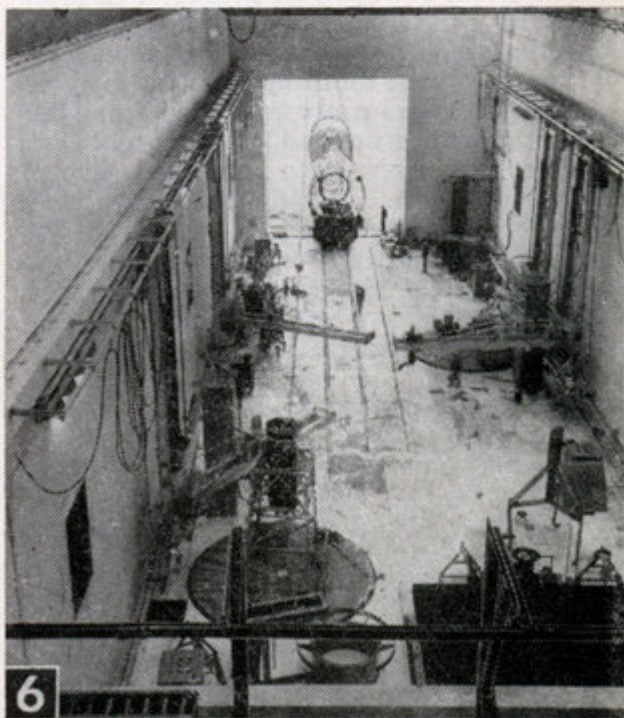


5

planes will become most apparent. Seconds after landing, the big plane will wheel to a radiation vault. There, either by remote manipulators or shielded vehicles, its reactor will be lifted out and remotely disassembled. Radioactive components will then be immersed in a water-filled "reactor well" to both cool the reactor and block the escape of deadly gamma and beta rays.

Only then, with the reactor removed, will a shielded escape vehicle wheel to the A-plane's cabin, mesh its tubular air-lock with the crew's escape hatch and provide a shielded runway through which crewmen exit.

Radiation Risks. Although some radiation, and the experts refuse to speculate how



6

The "hot shop" where GE test-runs its reactor and jet engines. Remote manipulators perform work involved in refueling reactors and handling radioactive engines. The 6-ft.-thick observation windows are filled with 500 gals. of zinc bromide.



A five-man crew spent five days in this mock-up of an atomic plane cabin to test their efficiency and endurance. Pilot sits at (A), engineer (B) and co-pilot is looking back from seat (C). One crew member stands at galley (D). Seats for the navigator and defense director are back to back with those for the engineer and pilot. Entire cabin is only 210 in. long, 90 in. wide and 72 in. high.

much, may leak from the less-than-maximum shielding, people on the ground would experience a negligible exposure while the ship flies overhead at 400 to 600 *mph*.

Inside the plane, crewmen will wear radiation dosimeters. When a man's dosimeter indicates a total 30-roentgen radiation dosage, he will be scratched from flying A-planes. Thus, unless every precaution is taken, a crew is no more trained than they are up to their radiation limit and must be pulled from the flight roster and grounded.

Nuclear engineers have computed several possibly critical crash situations and their probable radiation danger.

Two of these situations concern weather conditions. On a sunny, breezy day, fission products will quickly disperse with relatively little danger. But in bad weather, when dispersion is poor, more concentrated contamination would likely occur over a greater area.

Two other possible situations concern reactor crash damage. *Meltdown* could occur

when the reactor's core melts because of coolant system failure. This may not necessarily be serious as long as the reactor shielding remains intact. *Run-away* could happen if control failure permits the reactor to speed up until its fiery heat vaporizes the core. This could be serious because vaporizing releases more fission products than melting.

Weighing these variables—reactor damage and weather—the experts have arrived at an appraisal of crash danger:

No serious danger beyond 2,000 to 3,000 ft. of the crash.

Farther than one mile from crash site: no radiation high enough to cause even temporary sickness.

Yet under the most adverse conditions, such as a reactor runaway during bad weather, persons in a narrow belt as far as 35 miles downwind may receive "maximum permissible exposure," a non-damaging dosage, but nonetheless an appreciable exposure.

Strategic Design. The NX2's design speed of a subsonic 500 to 600 *mph* and its modest ceiling of about 40,000 ft. reveals, far more than does its odd configuration, its strategic mission as a CAMAL bomber (Continuous Airborne Alert Missile Launcher and Low-Level Penetration Airplane).

"Missiles have wrung the premium out of a plane's speed and altitude," says one designer.

Thus a new strategic concept: bombers with unlimited range and capable of penetrating radar defenses at extremely low levels.

CAMAL A-planes would maintain a continuous airborne alert. Ordered into action, they would drop to altitudes of 500 to 1,000 ft., but suffer none of the power loss common to low-flying jets.

Atomic-powered bombers will fit the CAMAL concept; they require no vulnerable mid-air fueling and could stay aloft almost indefinitely.

An atomic-powered plane has a nearly unlimited range. The limiting factor is the crew's ability to remain aloft for days in cramped quarters (Fig. 7) without suffering mental or physical breakdown.

Reactor-jet engines, fueled by superheated air, not by combustible and oxygen-dependent chemical fuels, are nearly as efficient at low levels as at high.

An A-plane's range isn't limited by the size of the payload. Add 1 lb. of payload to a jet plane and you increase gross weight (mostly in added fuel) anywhere from 3 to 10 lbs. The same pound would increase an A-plane's gross weight only 1.5 to 4 lbs. and this mostly in strengthening its airframe and landing gear, and increasing reactor size slightly.

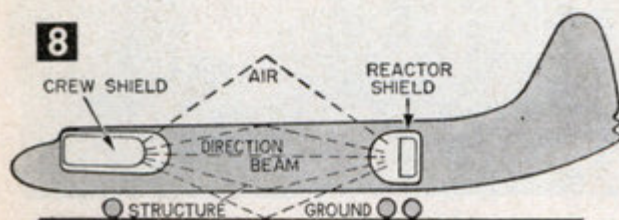
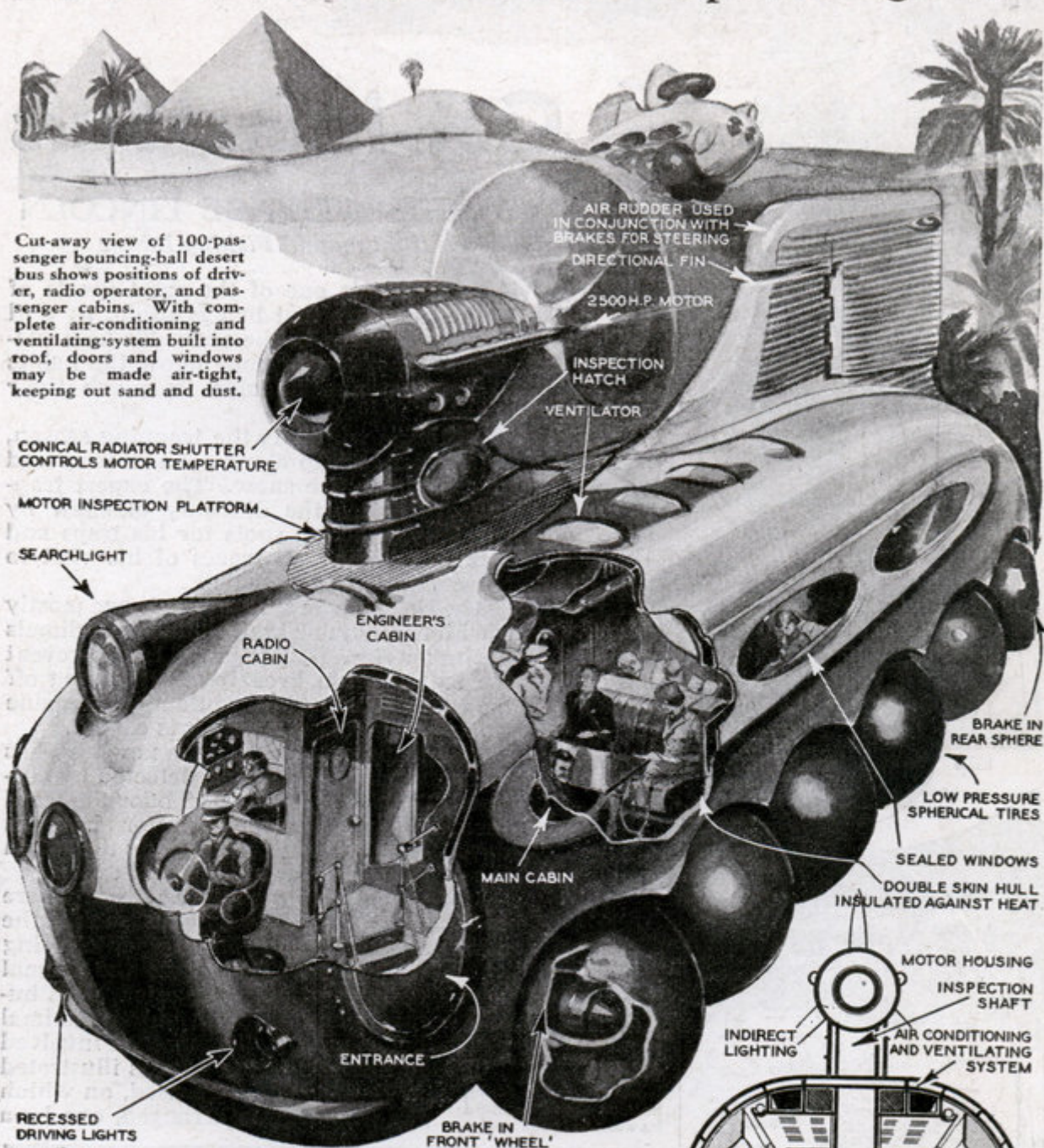


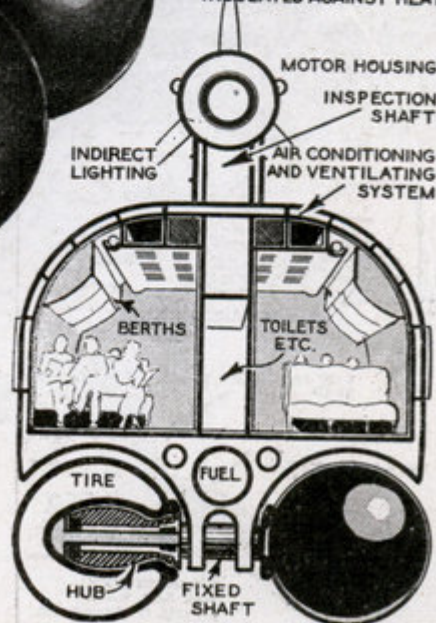
Diagram shows the effect of air, ground and aircraft structure in redirecting scattered radiation from the nuclear reactor and the problems involved in adequate shielding.

Aero-Drive Desert BUS Replaces Camels



PROTECTED from tropical sand storms, desert travelers of the future may be able to whiz across the Sahara in monster 100-passenger aero-drive buses following radio beam highways. Camel caravans would be out-moded by the standard of comfort possible in the proposed buses.

Preliminary details of this whirring, bouncing giant of the sands call for propulsion entirely by air, with a 2500 h.p. aviation engine and pusher propeller mounted atop the roof. Most unusual feature of the desert bus is a series of spherical tires on each side which would provide good traction over the shifting sands. Directly back of the propeller is a steering fin which controls the direction of the ship.



Cross-section of new desert travel ship, showing construction of inflated spherical rubber tires and mounting of motor. Brakes on front and rear wheels are independently controlled, permitting their use in steering the huge bus.

February

MODERN MECHANIX

AND INVENTIONS

NOW
15¢
IN CANADA 20¢



NRA
CODE

AERO-DRIVE
DESERT LINER
SEE PAGE 79

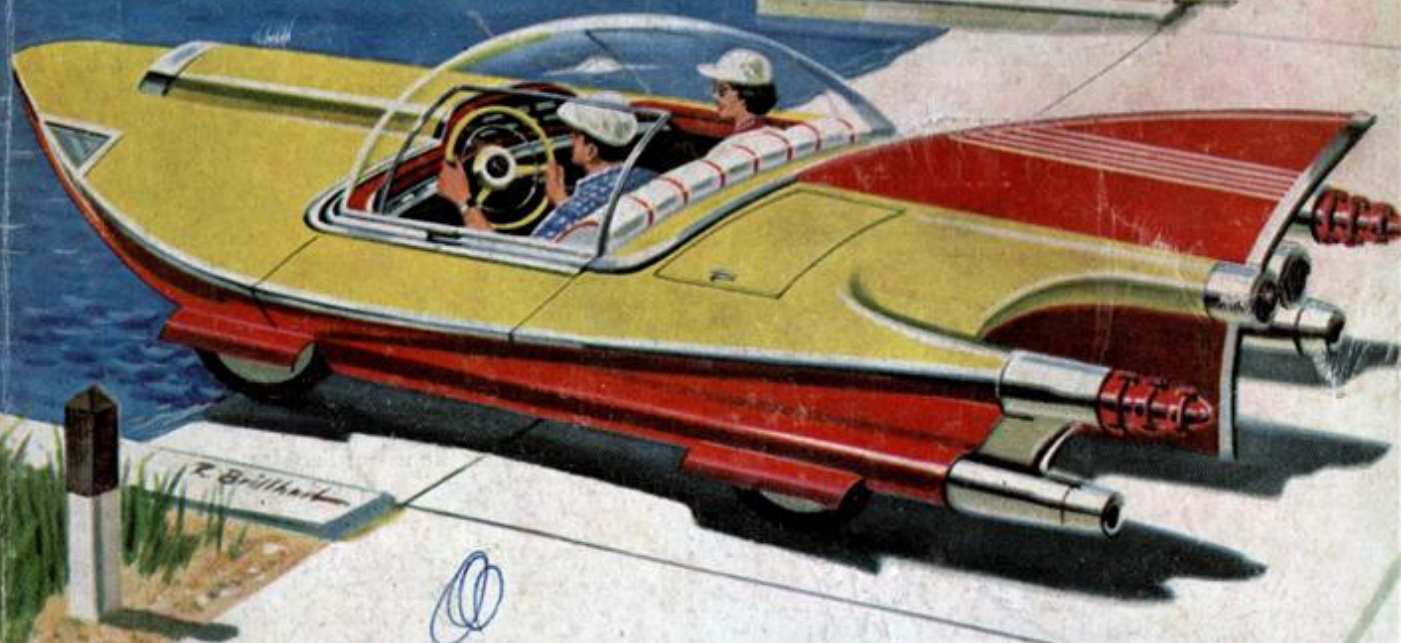
Around the World on
New Airways of the Seas
By Capt. Eddie Rickenbacker

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

Best Buy
25^c
APRIL

AMAZING NEW AUTOMOBOAT
Will Run on Land or Water
See page 76



Special Boating Issue!

24 Pages of Facts, Photos, Prices
of New Boats, Motors, Accessories

BASEBALL IN THE SKY • M

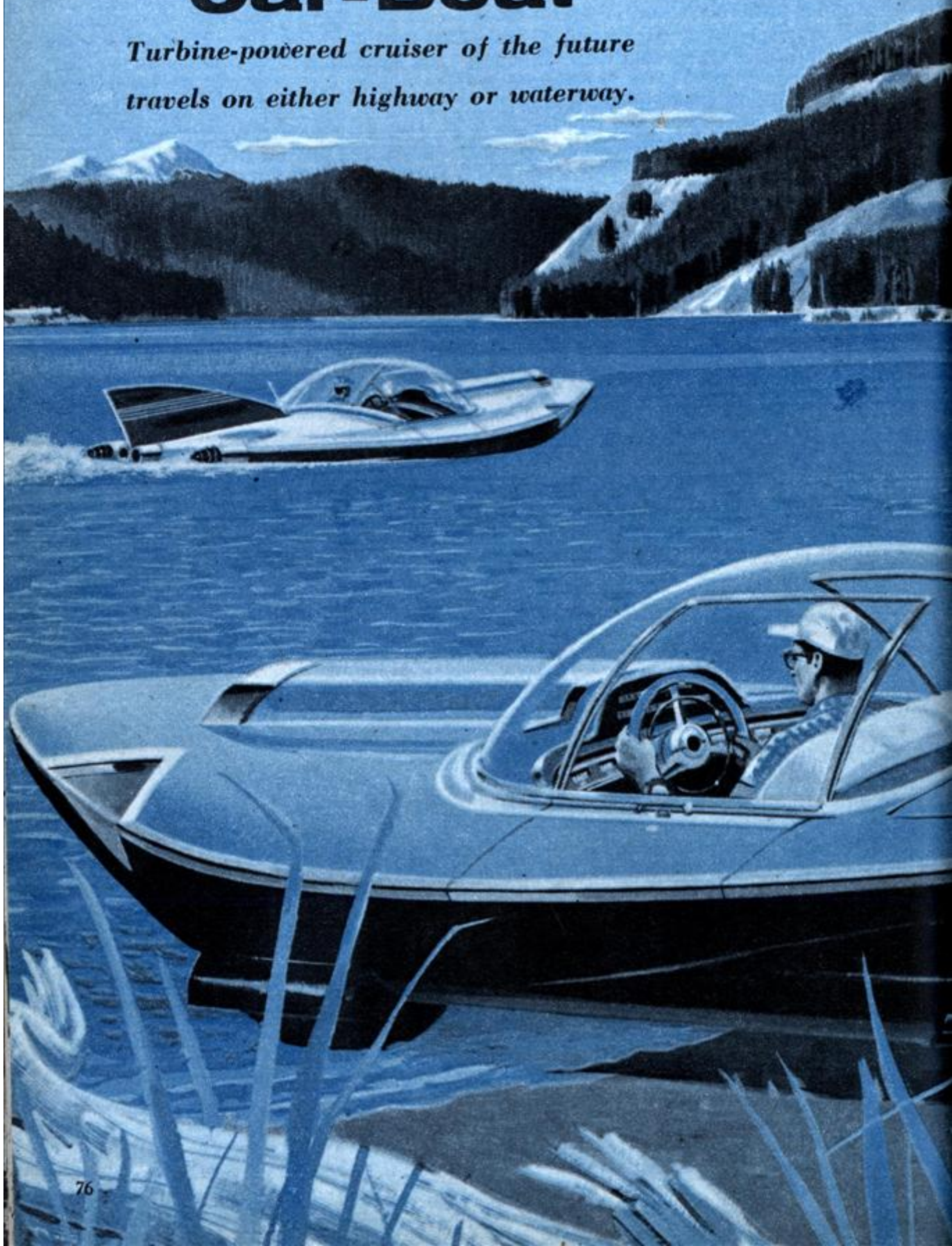
MONEY FROM THE SKY • ELS

TOM McCAHILL TESTS THE

K

MI's Wonderful Car-Boat

*Turbine-powered cruiser of the future
travels on either highway or waterway.*



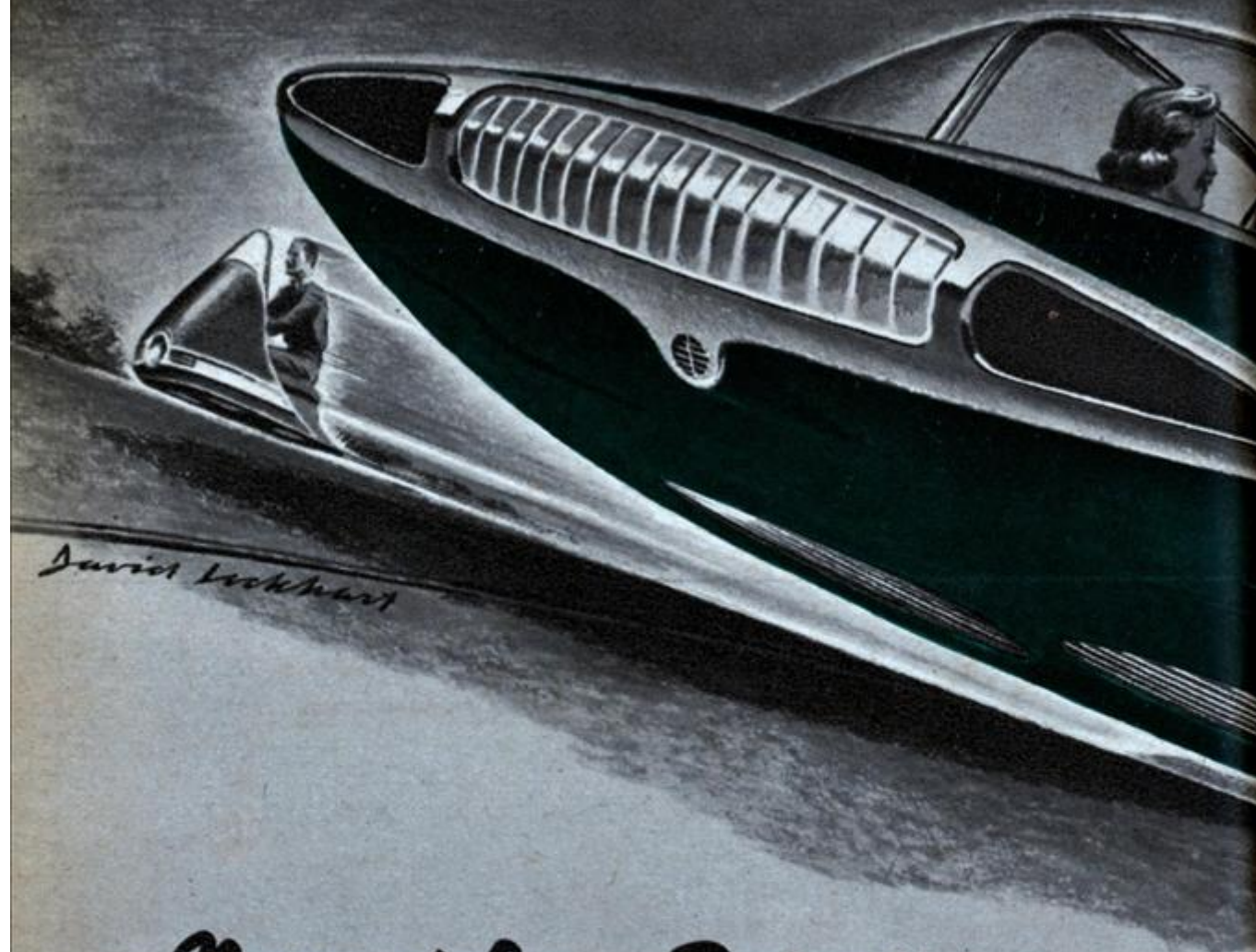
COVER STORY

SOME DAY in the near future a long, sleek car with a bubble canopy will drive down to the water's edge and then splash right in. Once afloat, its wheels will retract and the driver, shifting from gears to a jet thrust, will become coxswain of a speedy family cruiser.

This strange new vehicle will be the car-boat. Propelled by a gasoline turbine engine it will skim over highways at better than 90 mph and reach a top pace afloat of nearly 50 mph. The cabin will serve up air-conditioned comfort for its passengers and offer the riding ease of today's luxury cars.

[Continued on page 166]





Newest from Detroit...

Cars That

YOUR car of the future may have no wheels. It may not even touch the road as it races along the turnpike at speeds well above 100 mph while you and your family sit back and enjoy the ride—without fear of accident or injury.

This revolutionary new mode of travel was recently unveiled by the Ford Motor Company in the form of the Glideair—a wheel-less vehicle that rides on a thin film of air a fraction of an inch above the road.

Says Andrew A. Kucher, Ford's vice president in charge of Engineering and Research: "We look upon Glideair as a new form of high-speed land transportation, probably in the field of rail surface

A detailed illustration of a sleek, dark green, aerodynamic car flying through the air. The car is angled downwards from the top left towards the bottom right. Inside the car, a man is seen in the driver's seat, and a woman is looking out the side window. The background shows a landscape with a winding road, some trees, and distant hills under a cloudy sky. The car appears to be moving at high speed, as suggested by the motion lines around it.

GLIDEAIR is Ford's amazing concept of a wheel-less vehicle that would ride on thin film of air shooting through levapads beneath car. Levapads are also used on the futuristic motor scooter, far left.

Fly

travel, for fast trips of distances of up to about 1,000 miles."

A gas turbine or turbojet engine would supply the power to both levitate and propel the Glideair. Instead of wheels the vehicle would employ "levapads," a Kucher-coined word. Tiny jets of air would stream through holes in the levapads, supporting the vehicle. It is significant to note that levapads have already been designed to fit around a standard rail. They raise the vehicle from the rail and keep it away from the rail sides.

There are also others with their fingers in the wheel-less vehicle pie. Noted designer Carl Reynolds recently showed off

Cars That Fly

his concept of a car without wheels which he foresees by 1978. Mr. Reynolds says, "The highway cruiser, or large passenger car will float, or literally fly a short distance above the road supported on air compressed by turbine-driven ducted fans."

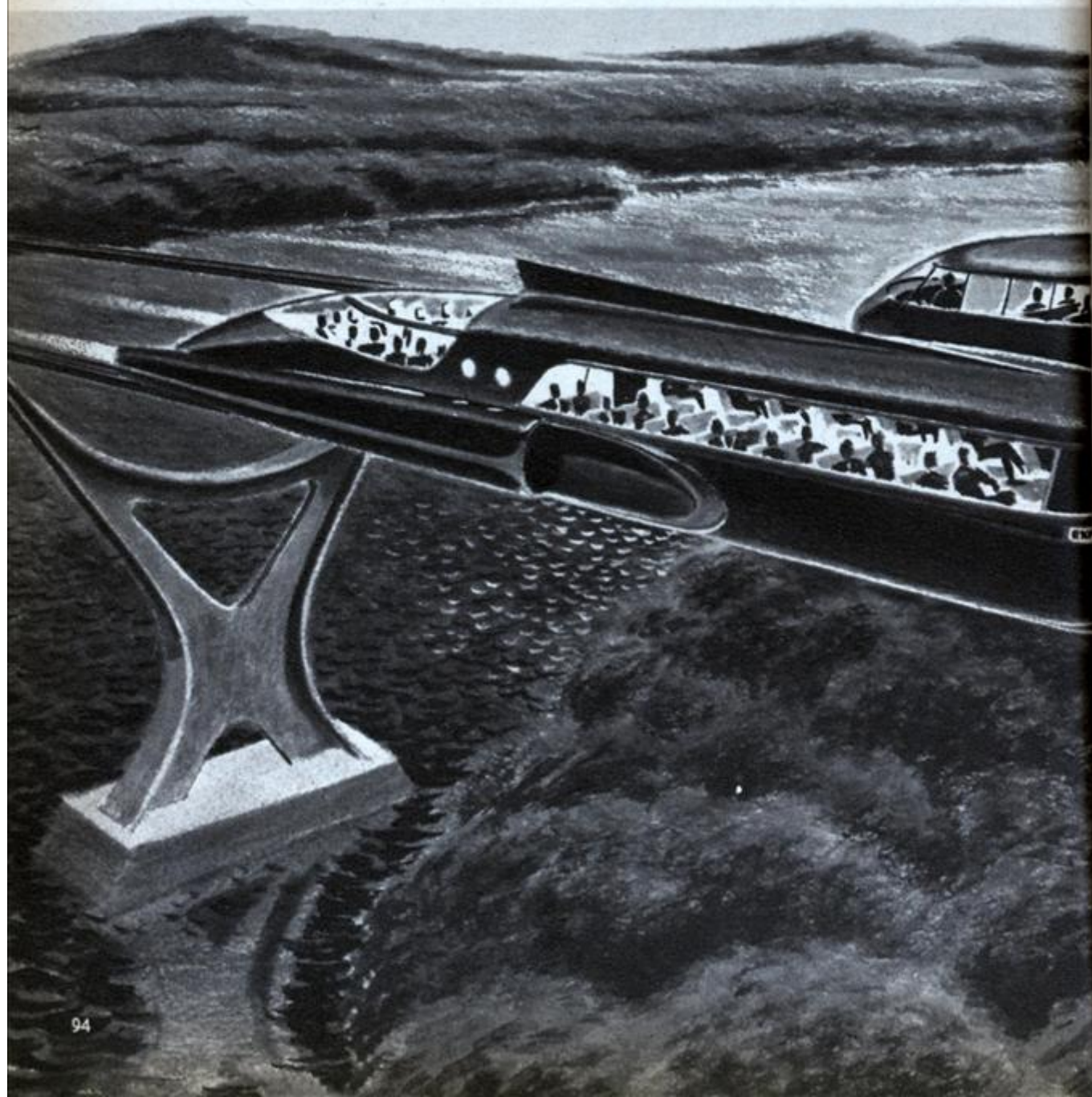
"In the wheel-less car," Reynolds goes on to say, "the driver's controls will be automated to simplify safe and effortless driving. . . Inter-city expressways will have electronic equipment for driver information as well as for traffic control and guidance. . . The car without

wheels will negotiate fairly rough terrain, even travel over smooth water!"

Piasecki Aircraft Corp. has a Sky Car in the works for the not-too-distant future. It will be an offspring of their 59-K, one of two Flying Jeeps being developed for the Army. The 59-K, which is "well ahead of schedule," according to the Army, is designed to combine the utility of ground jeeps with the hovering capabilities of small helicopters.

The Sky Car will be the civilian version. It will have no wings or conventional propellers and will be pow-

FANTASTIC speeds of 200 to 500 mph are foreseen in future for unwheeled vehicles using



ered by two horizontal three-bladed rotor-props, one at the front and one at the rear, which will support the craft on two columns of air.

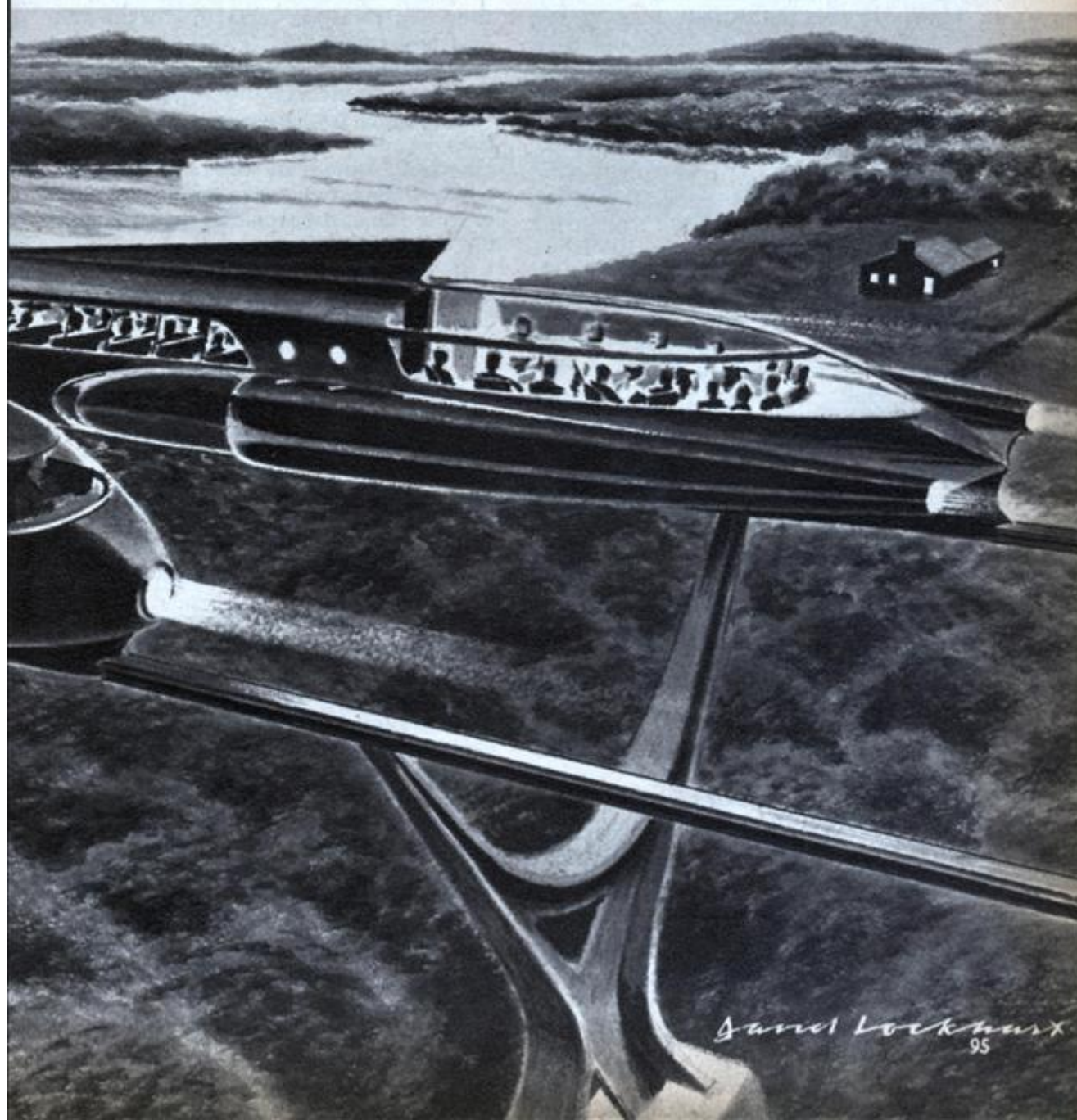
Both rotor-props will be shielded for safety and the Sky Car will hold a driver and three passengers. It will be able to fly down narrow streets or get above heavy traffic. It will also have powered wheels to drive it in and out of the garage or congested areas.

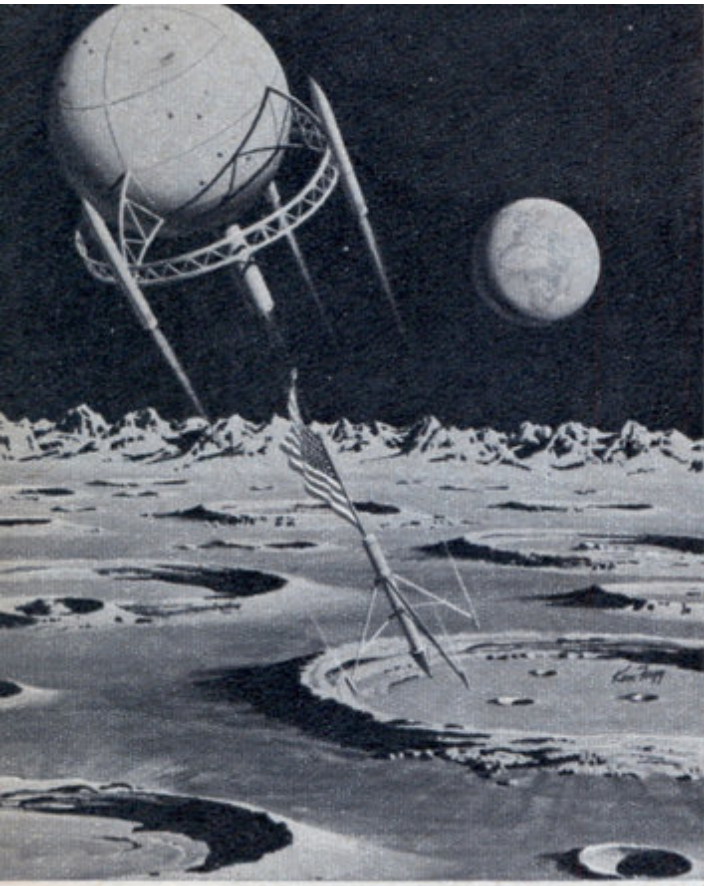
According to Piasecki, the Sky Car will cost little more than a high-priced motor car of today.

Ford also envisions what it calls an aero-car. Dubbed the Volante, the vehicle would be powered by means of three fan units arranged in a triangular pattern to provide lift and thrust somewhat like a helicopter.

That's the story of tomorrow's vehicles. How soon they'll appear above the roads is anybody's guess. Scientists are currently experimenting with the means to power such vehicles. One thing is certain—cars that fly are on the way; you may be parking one in your backyard in just a few short years. •

monorail system. Levapads would raise vehicle from rail, hold it away from rail sides.





LET'S CLAIM

We can beat the Reds with this plan for shooting our flag to the Moon by rocket.

By Pierre J. Huss

THE RUSSIANS, by their own admission, are getting ready to claim possession of the Moon. By 1970, judging from known Soviet plans for shooting rockets into the skies, the Moon will become sovereign territory of the Soviet Union—a "suburb" of Moscow.

Obviously, then, *now* is the time for

Last stage of rocket fires staffed flag which is set firmly on moon's surface.



THE MOON—NOW!

COVER STORY

us to stake out our claim to the Moon if the interests of free mankind are to be safeguarded for future generations. Otherwise, the Russians will beat us to the punch by grabbing first and talking afterward.

American ingenuity and enterprise and our scientific and technical know-how should be mobilized into a giant effort to overcome the obstacles and give the U. S. the honor and glory of staking out a claim to the Moon by planting the Stars and Stripes on lunar ranges and valleys via rockets!

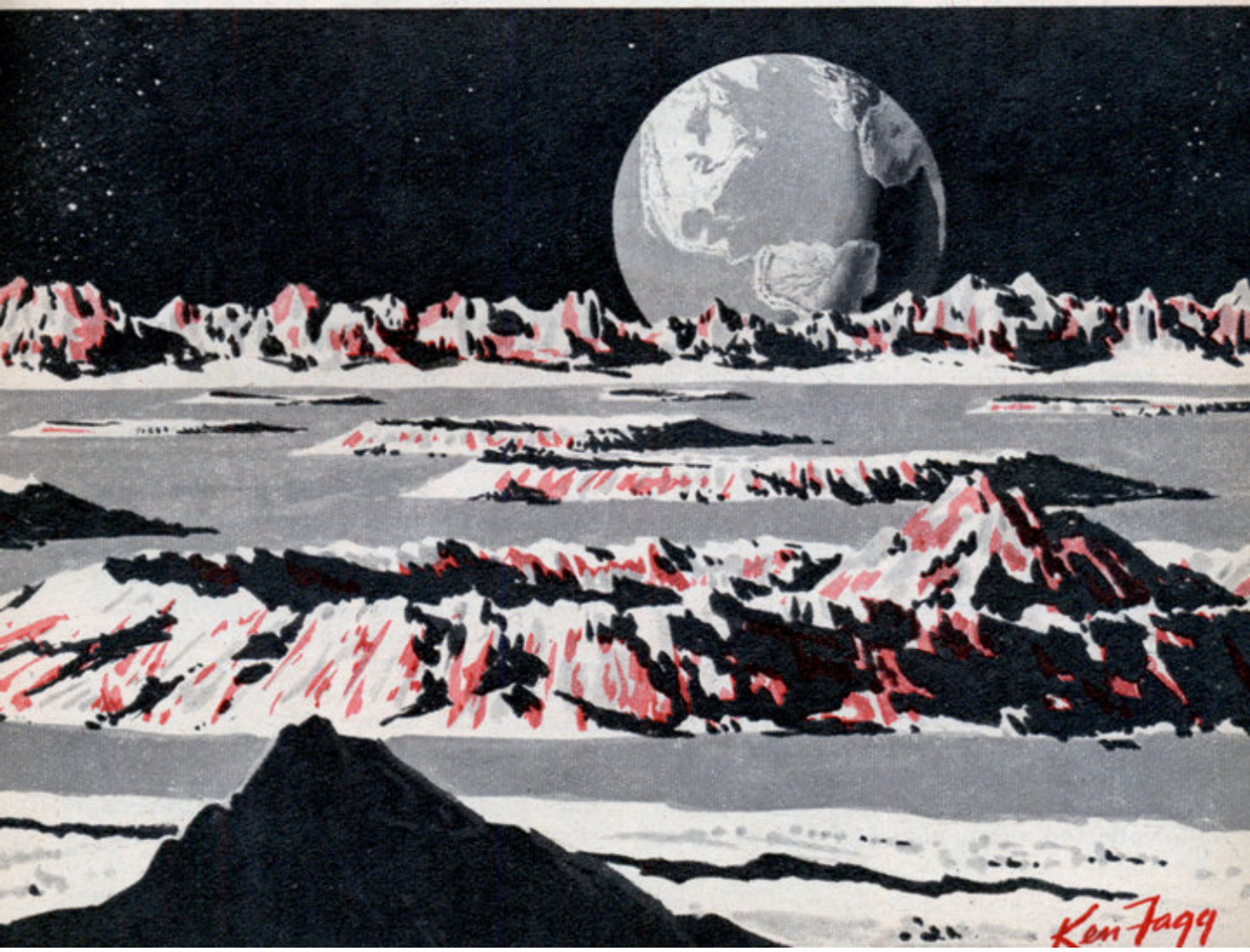
The Moon is so great a prize in shaping principles concerning space and interplanetary rights that now is the time for the U. S. Government to act boldly. Congress should issue an immediate

proclamation establishing jurisdiction over the Moon by right of first contact. The flag could follow as the clincher.

The first contact—and even the Russians haven't claimed this—was made with the Moon by the United States Army Signal Corps on January 10, 1946. Lieutenant Colonel John H. DeWitt made the historic contact by radar at Evans Signal Laboratory, Belmar, N. J. The powerful radio impulse shot at the Moon echoed back in two and one-half seconds, a round-trip of 477,000 miles. Here, then, is the first legal basis on which the United States Government can pin a technical claim of jurisdiction.

With the right of jurisdiction established, the U. S. Army Signal Corps, or any other interested governmental

International law recognizes ownership claim after nation's flag has been established.



Ken Fagg

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

Best Buy

25^c

FEBRUARY

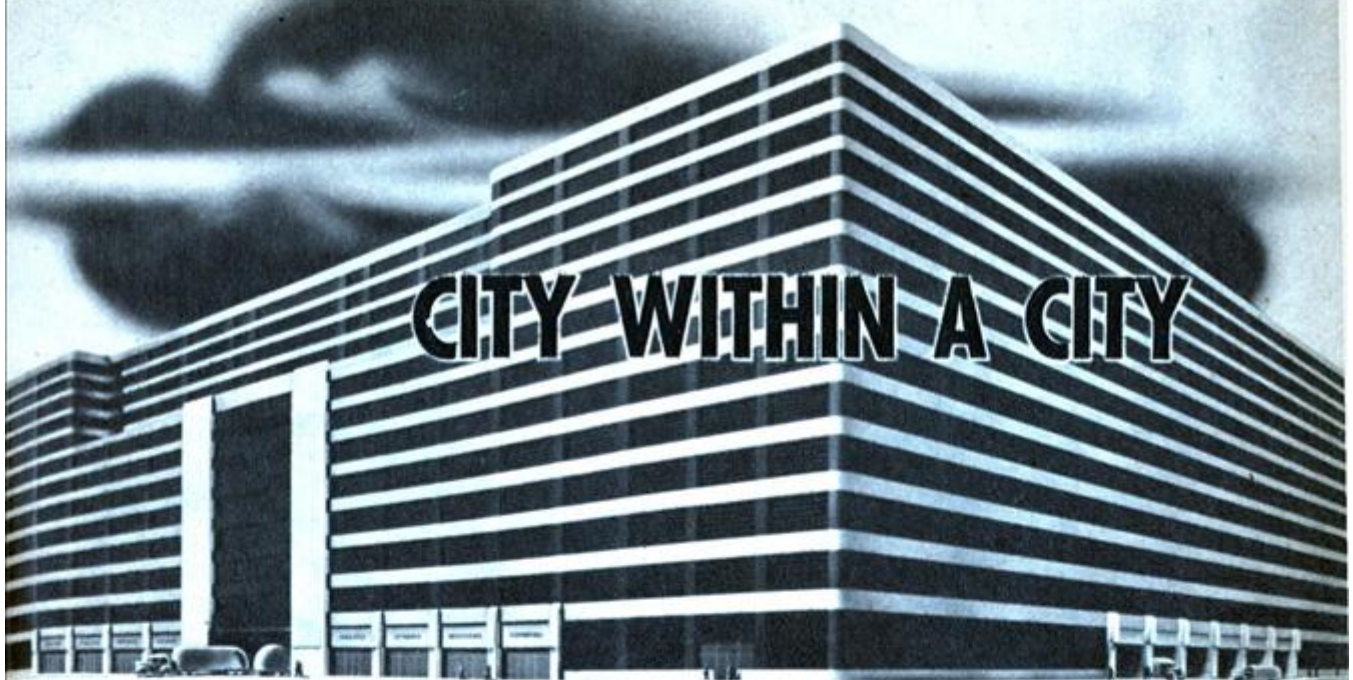
LET'S CLAIM THE MOON FOR
THE U. S.—NOW! See Page 70

HAVE FUN WITH A LIE-DETECTOR Y

ALL ABOUT HOME INTERCOMS • WO

VOI 13770P

RONALD HAMEISTER



CITY WITHIN A CITY

Equal in size to ten 10-story buildings, New York's Interstate Commerce Center will have an indoor highway.

THEY gasped when Tom Mix rode his horse right through the swinging doors and into a western saloon. They laughed when Olsen and Johnson drove a midget car into the elevator of a modern building and then through the halls to a lawyer's office. (In Hollywood, anything can happen.) But within a few months, New Yorkers will see the start of a building which, when finished, will swallow whole fleets of large trucks, trailers, and cars—said vehicles calmly driving into the building and thence upward on a spiral, four-lane indoor highway to whatever floor their business is on.

This unique "in-building highway," 32 feet wide and three-quarters of a mile long, and rising at a grade of only 6%, will be one of the outstanding features of the proposed Interstate Commerce Center building to be constructed by the Tishman Realty and Construction Company of New York. Thirteen stories high and covering an area of four square blocks strategically located on the threshold of the world's commercial marts and routes on lower Manhattan, the new building will be a revolutionary step in architectural design aimed at helping industry meet the inevitable changes and expansions of the postwar industrial era.

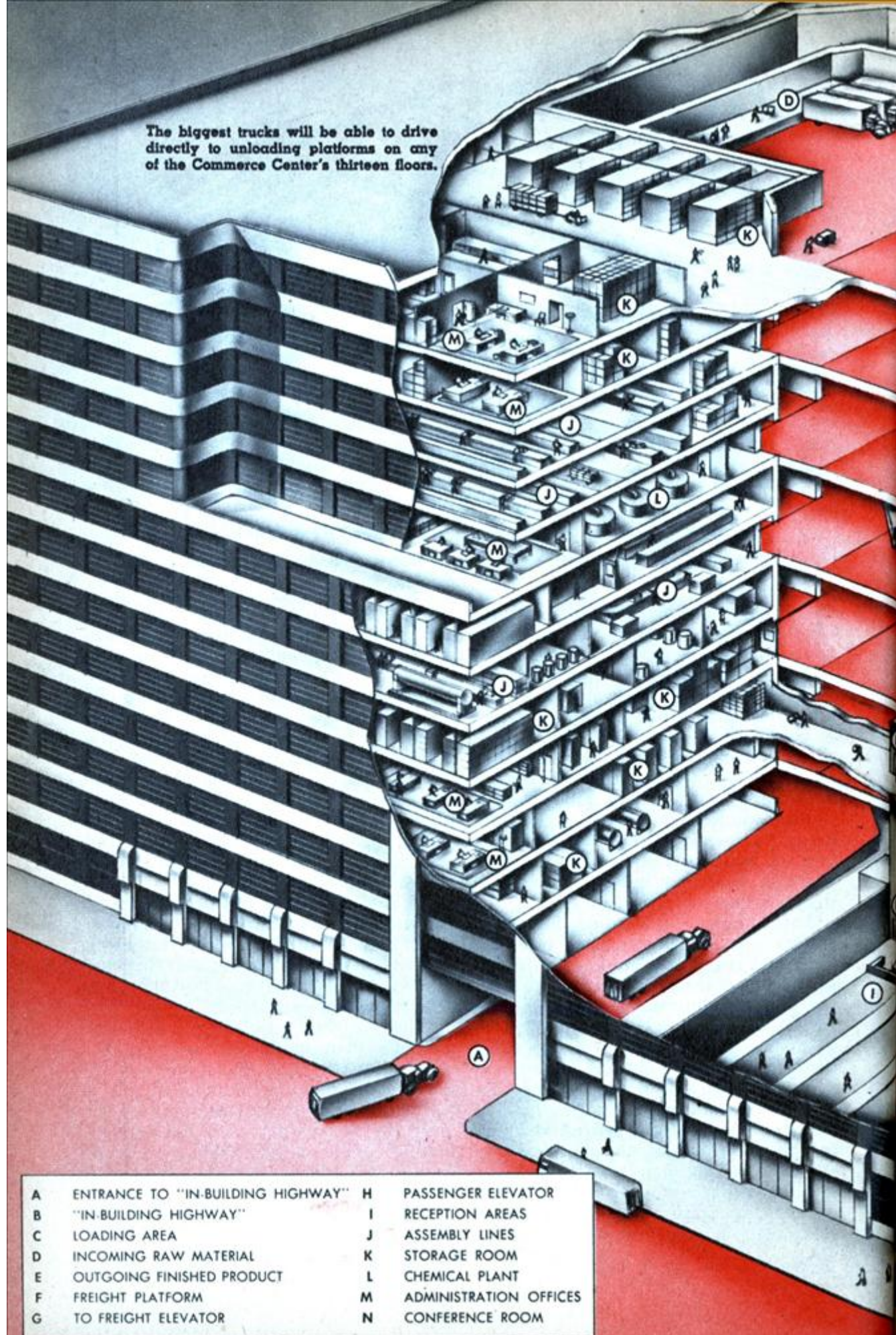
"Industry," observes David Tishman, President of the Tishman Realty and Construction Company, "is now confronted with a problem never before encountered—a problem that will necessitate drastic changes and improvements in business procedure. There are the tremendous potentialities of domestic and foreign markets; accumulated demands for new and replacement goods; an enormous expansion in aggregate buying power; revised distribution methods; and a labor supply far greater than that of the last prewar year.

"It is to coordinate this unprecedented demand, increase efficiency of operation in all branches of business and thus bring about lowered production and distribution costs, that the Interstate Commerce Center was designed."

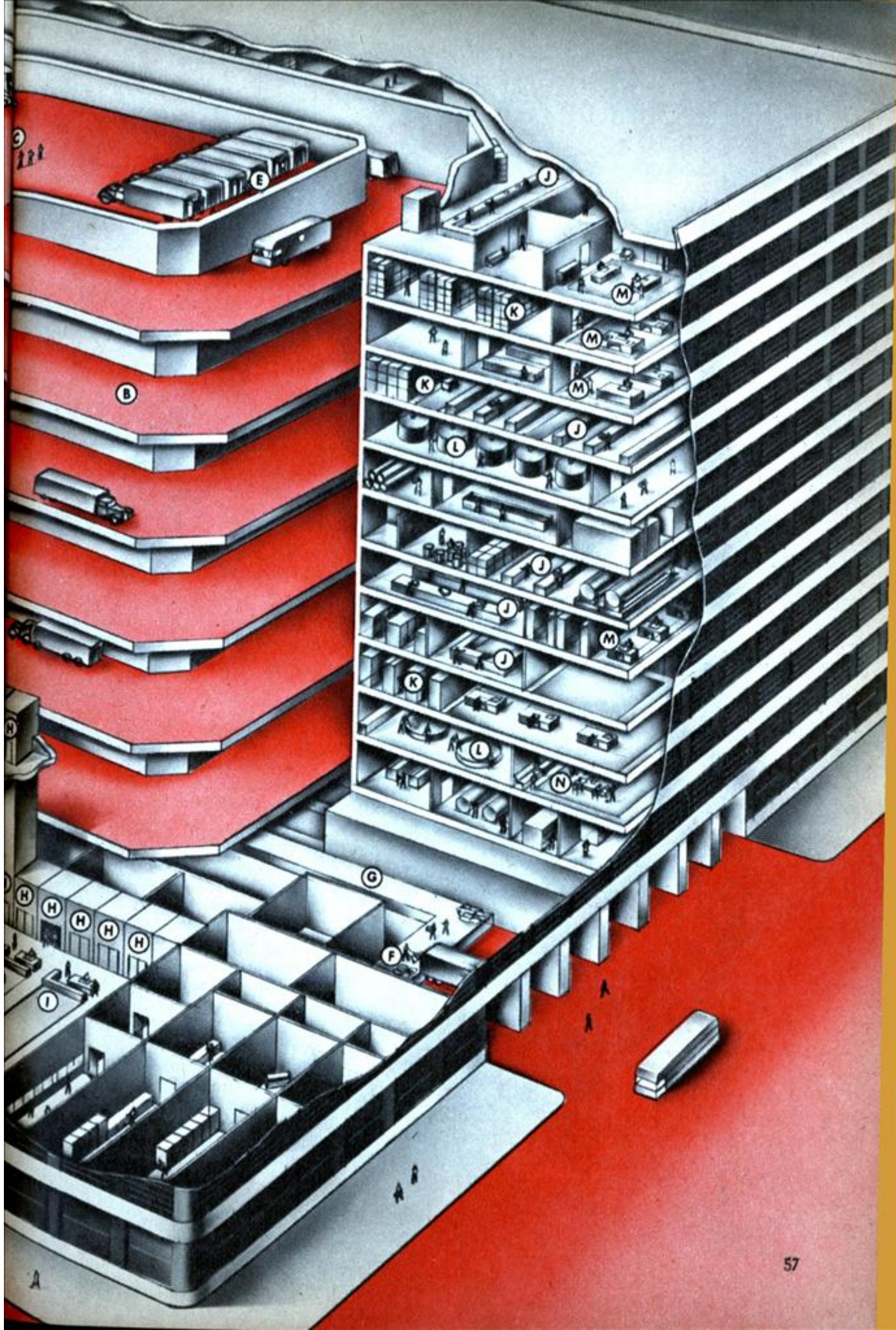
The \$15,000,000 building, which will be larger than the Port of New York Authority Building and second only to Chicago's Merchandise Mart, will be a veritable "city within a city," housing not only industries but also restaurants, beauty parlors, barber shops, and retail stores for the 25,000 persons expected to work there. Each organization, leasing one or more floors, will have its own private entrance on [Continued on page 162]

DRAWINGS ON NEXT PAGE

The biggest trucks will be able to drive directly to unloading platforms on any of the Commerce Center's thirteen floors.



- | | | | |
|---|-----------------------------------|---|------------------------|
| A | ENTRANCE TO "IN-BUILDING HIGHWAY" | H | PASSENGER ELEVATOR |
| B | "IN-BUILDING HIGHWAY" | I | RECEPTION AREAS |
| C | LOADING AREA | J | ASSEMBLY LINES |
| D | INCOMING RAW MATERIAL | K | STORAGE ROOM |
| E | OUTGOING FINISHED PRODUCT | L | CHEMICAL PLANT |
| F | FREIGHT PLATFORM | M | ADMINISTRATION OFFICES |
| G | TO FREIGHT ELEVATOR | N | CONFERENCE ROOM |



A PLANE FLYING ABOVE RAIN-BEARING CLOUDS CAN CAUSE SUCH CLOUDS TO LOOSEN THEIR BURDEN OF PRECIPITATION BY SCATTERING DRY ICE THROUGH THEM. THEIR MOISTURE THEN BURSTS INTO SNOW, FALLING INTO WARMER LEVELS AS RAIN

CRUSHED DRY
ICE FRAGMENTS

THICK CUMULUS CLOUDS
AT RIGHT TEMPERATURE

RAIN FROM MELTED SNOWFLAKES

We **CAN** Control the Weather!

The electronic computer makes it possible, says Dr. Zworykin, scientist.

BY WILLIAM WINTER, based on
an interview with **DR. VLADIMIR K.
ZWORYKIN**, Vice President and Tech-
nical Consultant, RCA Laboratories

Dr. V. K. Zworykin.



WHEN Mark Twain made his famous quip that everyone talked about the weather but that no one ever did anything about it, he had no way of knowing that the science of electronics, even then in its infancy, not only would promise a revolution in forecasting but would show the way to actually control the elements.

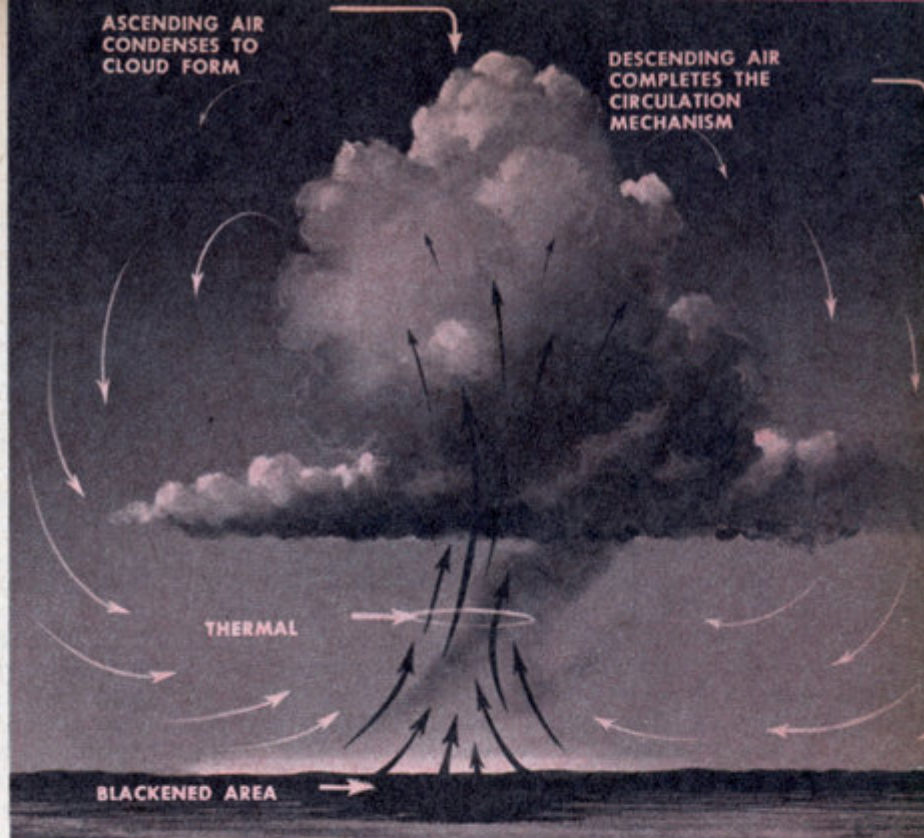
Yes, thanks to electronics we soon will be able to predict in a few minutes the weather for several days ahead. Even more important, man may be able to prevent the development of hurricanes and other violent storms, or divert them, prevent killing frosts, eliminate local fogs, and even cause rain to fall in regions of drought. The benefits to aviation and agriculture alone would be tremendous, to say nothing of the direct savings in lives and property.

Many earlier attempts at controlling the weather will spring to mind. By dropping "ice seeds" or electrified sand from airplanes clouds have been forced to give up their moisture as rain. The Swiss have dispelled threatening hailstorms by setting off explosives. Other smaller but, perhaps, more familiar methods of weather control may be

Mechanix Illustrated

found in the smudge fires that protect our citrus groves from frost and in Fido, the system developed by the British for clearing fog from airplane runways by burning oil. But, although local emergencies frequently justify the cost of such measures, their application on a grand scale would be prohibitively expensive. Such methods are the equivalent of locking the stable door after the horse is out. The trick is to interfere with a dangerous weather condition when it forms, rather than fight it as a full-blown hurricane. Until now this was a remote possibility, indeed. It is the development of the electronic computer as a means of weather forecasting that will permit meteorologists to tell where and how they can apply man-made corrective measures to the weather.

At present a meteorologist has two ways of making a forecast. After assembling data on pressure, temperature, humidity and wind velocity at various altitudes, gathered at weather stations over a wide area, he can apply the laws of physics to the motion of air masses,



HOW SUN-HEAT-ABSORBING GROUND CAN START A THUNDERSTORM

the formation of cloud systems, the absorption of solar energy by the atmosphere, and other weather phenomena. If this sounds complicated, it is complicated—so much so, in fact, that rather general formulas must be substituted for the desirable but time-consuming fundamental calculations. The second method involves the comparison of the weather map with earlier maps for which the subsequent weather has been recorded. For accurate forecasting the meteorologist needs to

blend both methods. But he cannot. By the time we could ascertain that it was going to rain, it would be raining. Accurate prediction by present methods is hopelessly slow—but the work that now would occupy the forecaster for two or three days can be handled in as many minutes by the electronic computer, now being developed by the RCA Laboratories as a joint project with the Institute for Advanced Study.

A few examples may point up the importance of this instru-



Dr. W. C. Jacobs, expert in Applied Climatology, looks over a summary code report worked out by a robot "weatherman."

ment to science. Let us assume that it is important to predict the position of the moon 200 years from now. The best mathematicians working with the best Comptometers would require 50 years to find the answer. The electronic computer can solve the problem in two to three hours. The multiplication of two numbers of as many as twelve digits (one thousand billions) can be completed in several millionths of a second. It is this incredible speed that enables the computer to solve complex weather data in a matter of minutes.

How do you control a hurricane? Nature supplies many clues. For example, large cloud masses rise to great altitudes at certain times of the day over south sea islands. Recurrent thunderstorms have been found to center over large burned and blackened areas in Africa. We know that the heat of the sun's rays causes air to rise and that, when in rising that air becomes sufficiently chilled, condensation and rain will follow. When there is a temperature differential at the surface, such as over an island and the surrounding cooler water, the rising warm air will suck in the adjacent cooler air, thus set-

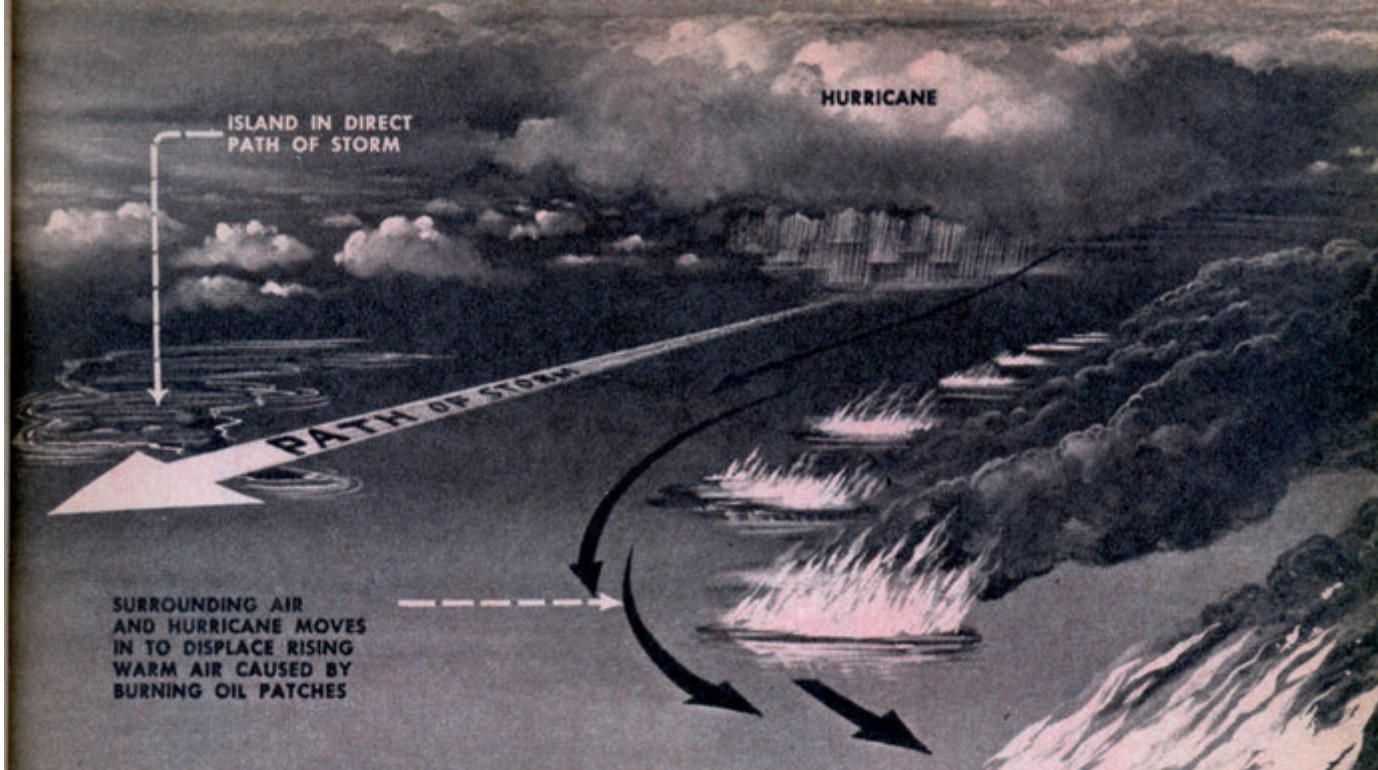
ting up a circulation that rapidly builds up energy in a cloud or storm formation.

According to Doctor V. K. Zworykin, "The hope for effective weather control rests in the fact that the condition preceding many of the weather processes which it may be desirable to control is essentially unstable or metastable, characterized by the accumulation of large amounts of potential energy during an extended period. Thus, while the energy finally released may be enormous, that required to trigger the release may be quite modest." Man can trigger the release of this energy with the guidance of the computer and by using nature's principles of weather making.

There are two ways to do this. One is the use of strategically located "weather control patches" or carbon-blackened areas which would vary the rate of absorption of solar heat. (Remember the African thunderstorms?) The rate of absorption of these patches can be controlled by covering them with artificial fog. Properly applied, these patches would artificially create a circulation of rising air that could precipitate a budding storm on the spot. The second method

Kathleen Roan, 17, works her home-made snow-maker. She breathes into the iced tub, throws in fragments of dry ice, and gets a fall of snow.





HOW EXPANDING WARM AIR MIGHT TEMPT A HURRICANE FROM ITS COURSE

is to spread a combustible material, such as oil, on the surface of the water and to ignite it. For a specific example, consider the hurricanes that habitually strike the Florida coast. It should be possible to abort such storms in the Belt of the Doll-drums, north of the equator off the west coast of Africa, the birthplace of these blows. Although the rotary speed of the storm is impressive, the speed of the storm center across the earth's surface is not very great, oftentimes but a few miles per hour. This fact means that we may be able to steer a storm into an area where damage would be minimized. Again, it would be the electronic forecaster that would tell us how.

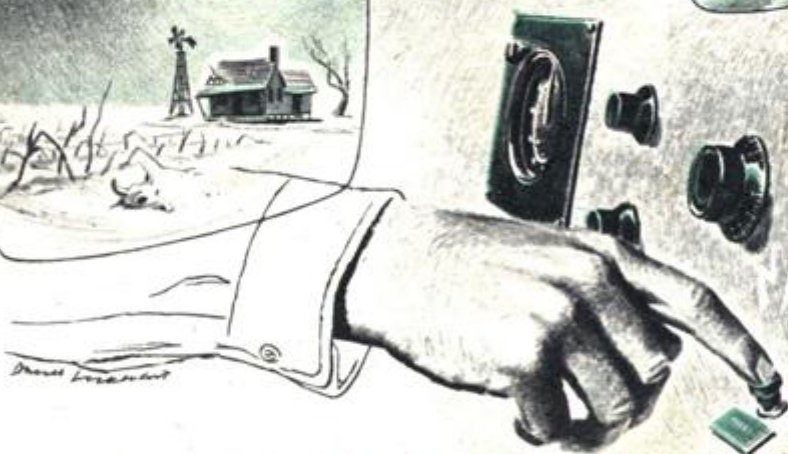
All this, of course, would be sheer nonsense if we depended on any mechanically or humanly limited equipment. But, when a storm threatens, the meteorologist can feed into the computer as an experiment data on what he proposes to do. If necessary he can quickly run a whole series of these experiments and observe almost simultaneously the effect of applying given amounts of energy at different points on the weather map. Within a few minutes he may be able to determine the most economic and effective remedy for the bad weather.

At this writing it is not possible to say exactly how big the computer will be, or just what it will look like. It will contain several thousand tubes (one famous computer had over 20,000), 40 being Selectron

tubes, newly developed by Dr. Jan Rajchman, one of Dr. Zworykin's associates. Each of these tubes has the amazing ability to handle or store in its "memory" 4,096 different signals or bits of information. Thus the 40 tubes combined give a capacity of 163,840 signals. What seems even more fantastic, any one of these signals can be read in a few millionths of a second.

Each Selectron tube contains two sets of fine wires, set at right angles to each other, between the source of electrons and an insulator on whose surface electrostatic charges called "writing" can be stored. The crossed wires in effect form a checker-board of windows. Any desired window can be opened electronically to take a reading. These readings can be repeated as many times as necessary and at arbitrarily long or [Continued on page 154]





Control the Weather and Control the World

*Will we win the crucial race
to gain mastery over this
most devastating of all weapons?*

By Dick Halvorsen

WORLD WAR III, if it comes, may be won or lost, within 48 hours—and without a single A-bomb dropped or a single shot fired. We could win the next Big One by harnessing the mightiest physical force in the world: the



One of 37 planes wrecked by '49 hurricane atop wreckage of hangar at West Palm Beach.

hitherto uncontrollable weather.

Fanciful nonsense? Crazy day-dreaming? Science-fiction? Not a bit of it. Consider these startling facts:

A hurricane expends more energy in one minute than all the electrical power produced in the United States in the past 50 years. . . .

Hurricane Edna, which ravaged the east coast of the U. S. in 1955, had more raw power packed in its 100-mph gales than all the A-bombs dropped since Hiroshima. . . .

Off Luzon in the Philippines in 1944 a tropical typhoon swept down on three destroyers of the U. S. fleet. Each of the tin cans boasted 60,000-hp engines—but their strength was as nothing against the fierce winds and all three warships turned turtle and sank with all hands. . . .

The crushing Pacific typhoon of October 1945 sent seven warships to the bottom, drove more than 200 aground, wiped out army installations, roads, bridges and cities on Okinawa and killed hundreds of men with its 180-knot winds and 50-foot waves. . . .

Tornadoes of 1952 destroyed a good percentage of the fighting strength of the

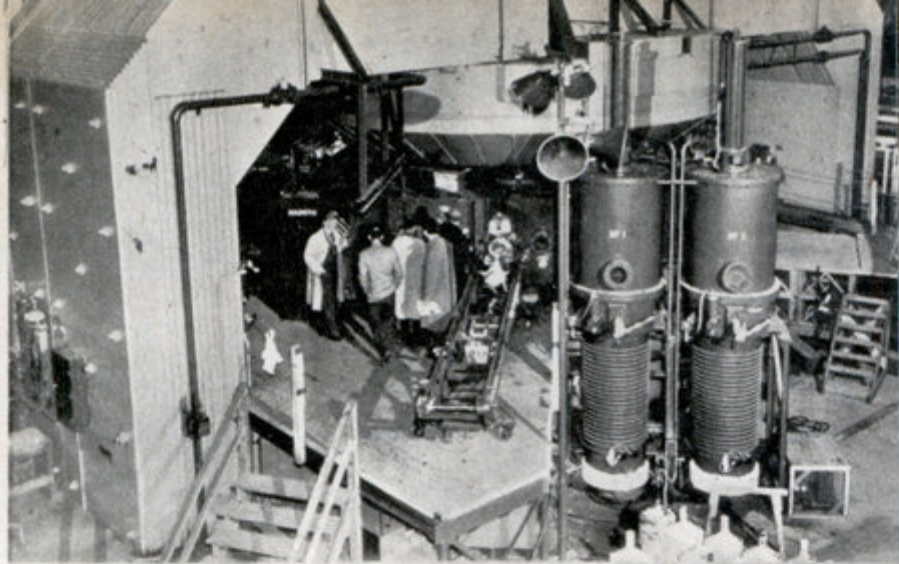
Strategic Air Command, smashing expensive fighters and giant bombers into worthless wreckage. . . .

Hurricane gusts bend steel plate like tin foil, crumble concrete wharves, rip up forests, crush bridges. A tornado can drive iron rods through telegraph poles. Floods and winds have caused more devastating than all the puny weapons of man since time began.

How could weather be used as the most powerful weapon the world has ever known? History books of the future may well contain the following chapter:

"The attack against the United States was launched early on the morning of September 26, 1960. The enemy struck at half a dozen points, using submarine fleets to surprise and capture U. S. installations at Iceland, the Azores, Hawaii, Bermuda and Spitsbergen. Following the troop-laden subs came vast air armadas and then three great invasion fleets, two in the Atlantic, one in the Pacific.

"America met the attack, not with A- and H-bombers of the Strategic Air Command, but with the squadrons of the



Physicists and guests have a look at Berkeley's giant new 4,000-ton cyclotron which produces atomic bullets with energies of 200 million electron volts.

by investigators for the past two decades.

What are cosmic rays?

They are powerful particles of energy, originating as individual elements similar to light photons and electrons, which are shot like bullets from the vast unknown regions of interstellar space to all parts of the earth, day and night.

After entering the atmosphere at tremendous velocities, the streams of cosmic ray particles collide with the nuclei of atoms of air, bursting them apart and imparting to the particles so formed even higher velocities than the original particle had.

The particles produced through such cosmic ray-atmosphere collision are about 200 times the mass of an electron and are known as mesons.

Each minute every human being on earth is being hit and penetrated by thousands of these mesons. The individual one has measurable energies up to as much as two billion electron volts. Since the gamma rays of an atomic bomb explosion are only two million electron volts, cosmic ray energy may therefore be a thousand times greater than any produced so far on earth.

Fortunately the density and duration of life of the rays is low, far below the point where they can do harm to human beings.

But how would one go about constructing a lethal cosmic ray-gun using these mesons?

A beginning has already been made in the United States. University of California scientists, leaders in building cyclotrons and other atom smashers,

have constructed an experimental "linear accelerator"—an atom cannon that hurls a stream of protons, the nuclei of hydrogen atoms, in a straight line instead of in the spiral orbits of the lesser energy particles of the cyclotron. This means that the apparatus will energize the atomic projectiles toward the billion electron volt mark and places them in the class of cosmic rays.

The unit is only 40 feet long and is flanked by batteries of obsolete radar sets, 15 of which are installed at equidistant spaces along the outer copper tube of the accelerator. Inside the tube is a sectioned, rifle-like barrel through which the protons are shot. As they pass each section of the inner tube they are accelerated or given a "push" by the respective high-frequency radar outfits, to finally emerge at about 40,000,000 electron volts at the muzzle.

After this initial model has been fully tested, a larger pilot model, 280 feet long, with seven 40-foot sections, will be built. To reach cosmic ray intensity it is estimated that an apparatus 1,000 feet long would be required.

Obviously this length would be impractical in modern warfare, but it is not unreasonable to suppose that still more powerful electronic energizers can be made to impart still more billions of electron volts of energy to the protons, all within the confines of gun barrels of usual length.

Once this is accomplished, we will have a usable cosmic ray-gun, the first real death ray. Such a gun could be mounted in heavy bombing planes, in

MECHANIX ILLUSTRATED

APRIL

A Fawcett Magazine

STILL
15¢

REAR-WING
PUSHER AIRLINER
SEE PAGE 60

ATOMIC ENERGY TO FIGHT CANCER
BUILD A CONTROL-LINE MODEL MUSTANG

MECHANIX ILLUSTRATED

~~20¢~~ Now
15¢

JANUARY



Helicopter Sky Hook
See page 44

SCIENCE TRANSPLANTS UNBORN BABIES
SECRETS OF MUROC—GREATEST AIR BASE IN THE WORLD

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

FIRST MAN
IN SPACE

Best Buy
25¢
DECEMBER



NEW WAYS TO IMPROVE TV RECEPTION

January • February • March • April

May • June • July • August

September • October • November **December**

**Mechanix
Illustrated**

1958

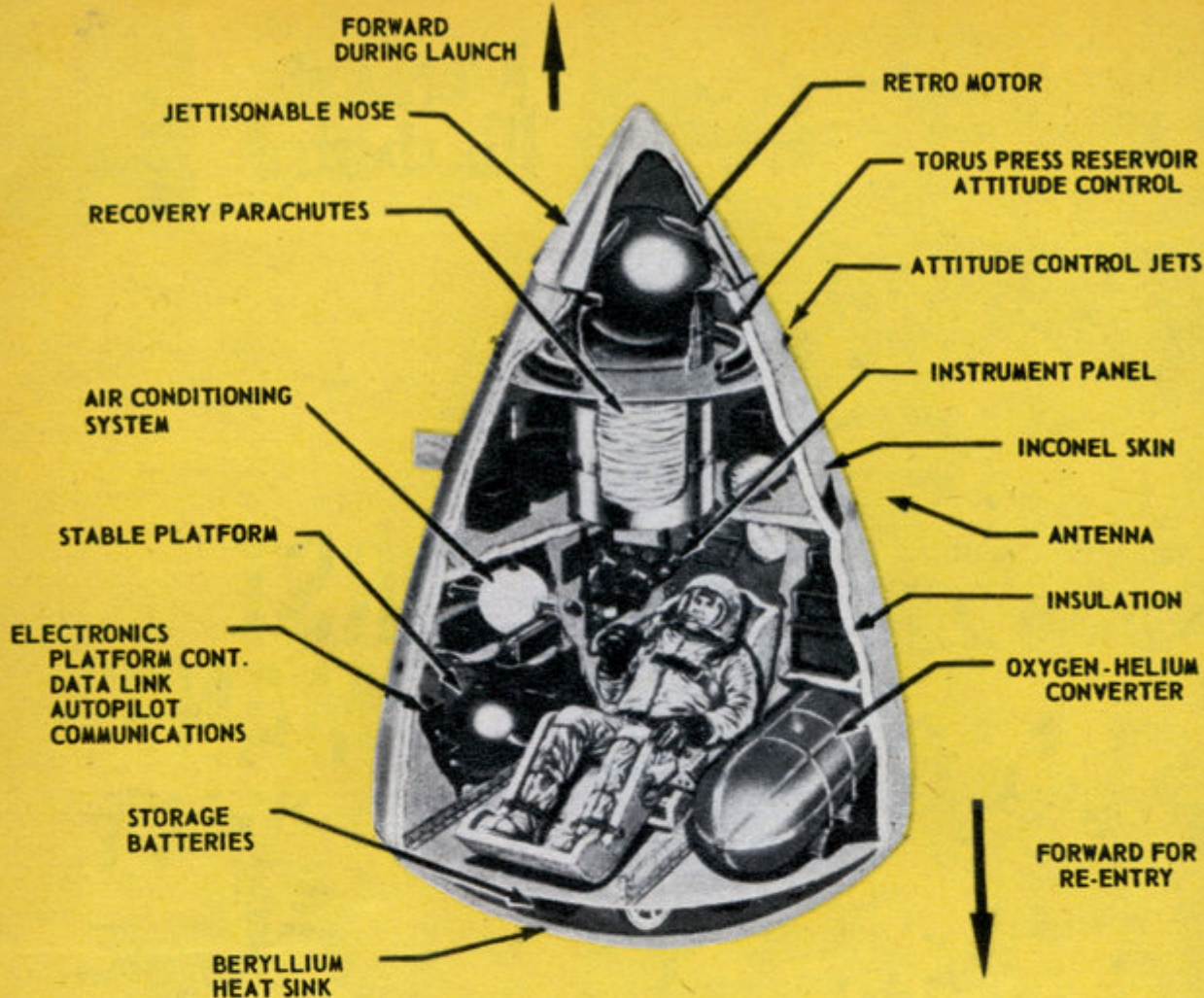


FIRST MAN



IN SPACE

By Harry Kursh



PROJECT BROOM (Ballistic Recovery Of Orbiting Man) is Northrap Aircraft, Inc. plan. Diagram of proposed recoverable space capsule above. Cover shows capsule during re-entry. Photos on preceding page are an Atlas blast-off and space feeding device developed by American Can Co.

YOU'RE a special breed. That's why you've been selected to be the first man into space. You squirm nervously in your space suit inside the ballistic-like metal container designed to hurl you into orbit. Outside, in an underground blockhouse, the project engineer's finger is poised over the blast-off button. The countdown is in its final seconds—five, four, three, two, one—fire! . . .

It all started about five years ago. You were 28 then but had been crazy about flying since you were a kid. You were just out of college with a solid background in science and engineering, ready to be converted into a walking encyclopedia on such subjects as space medicine, electronics, mathematics, astronautics, rocketry and thermody-

namics.

When you volunteered for space-pilot training you had the primary requisites: you were under six ft. and between 165 and 185 lbs. As evidence of emotional stability, you were married and the father of a child. You passed a battery of psychological tests that proved you could work as an integral part of a team or remain alone for days or weeks at a time.

The training program was rigorous and demanding. You lived, ate and breathed space—night and day, seven days a week. You catapulted out of supersonic jets, performed strenuous and intricate maneuvers at speeds up to 2,000 mph, worked with engineers (talking their language), attended endless classes and traveled coast-to-coast

subjecting yourself to a series of the most murderous tests that science could devise.

You were strapped into a giant centrifuge at the Johnsville, Pa. Naval Air Development Center and whirled at speeds that made you feel as if you were smashed against a stone wall at 100 mph. Sometimes you bled from your eyes, ears, nose and mouth. At Randolph Air Force Base in Texas, you lived in a space chamber, all by yourself, completely out of touch with "earth" for four or five days in a row.

Then you were ready—and chosen from a handful of selected volunteers to make the first manned flight into outer space. When you step into your space suit you will have the responsibility for an experiment that has cost almost ten billion dollars and taken ten years of extremely difficult research. Yet if a minute hole should develop in your suit in outer space, your blood will boil and you will be dead in 15 seconds.

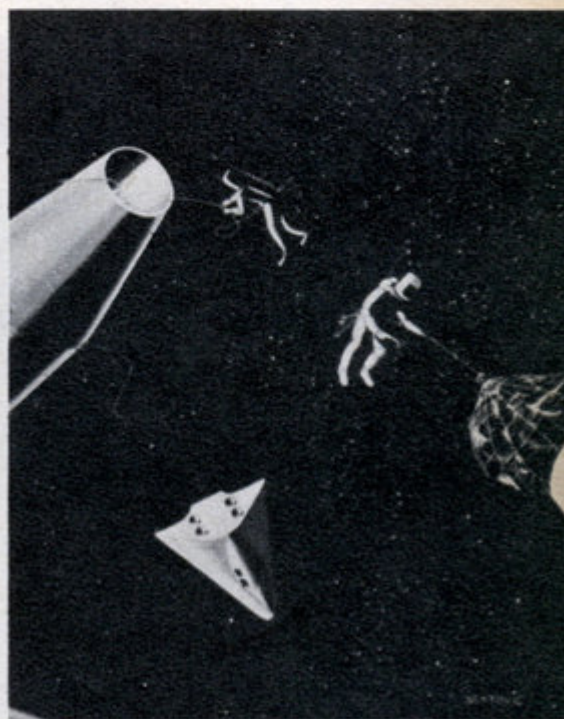
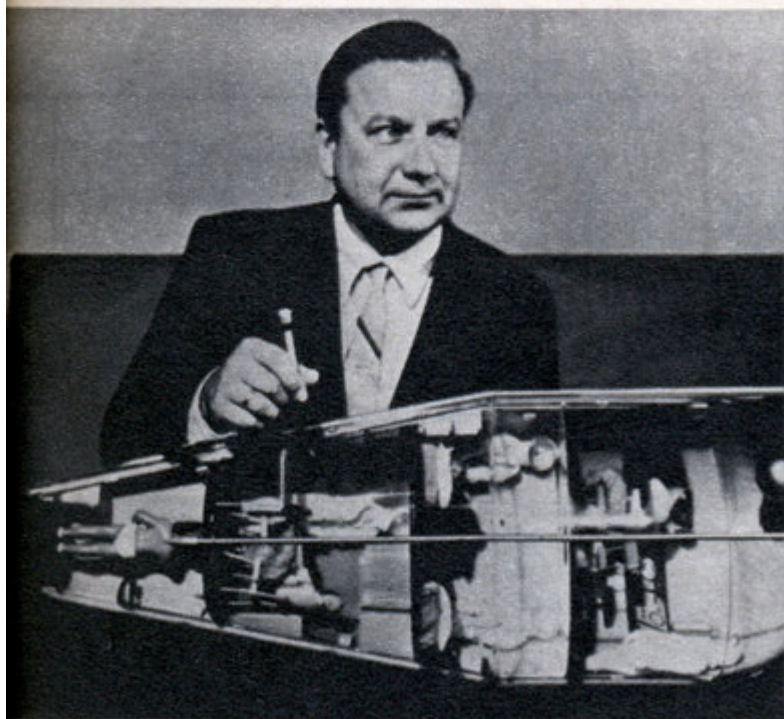
You think about such "details" as you are escorted to the Cape Canaveral, Fla.,

launching pad. The chief project engineer comes over to supervise placing the helmet over your head and for a final briefing. From now on you will communicate only over the intercom.

About 100 feet away, in a steel and concrete blockhouse built two stories below the ground, a score of men sit before an incredible maze of control panels. Some have their eyes fixed on a battery of closed-circuit TV screens. They watch you being strapped into a reclining chair inside the space vehicle. Its gleaming metal surface is flawlessly smooth and it's laden with instruments which leave no room for error.

It is a blunt-nosed shell about ten ft. long and seven ft. wide at the base, with built-in tail fins that have to spring into position more than 100 miles up—otherwise you'll have to explode yourself out still attached to the base of the cockpit, returning to earth like a flying platform—under a huge parachute.

Now a huge crane picks up the space craft and [Continued on page 161]



ATLAS SPACE STATION has been suggested by Krafft Ehrlicke, at left, of Convair-Astronautics. He envisions putting an Atlas ICBM into permanent orbit, right, and supplying crew and equipment by other missiles.

ACCUMULATOR CONE

ANTI-SPRAY
GUARD

HAWSERS LINK UP
NUMEROUS UNITS
TO TOWING SHIP

DOUGLAS
ROLFE

Drafting The Sun for Defense!

SUPPOSE magicians could be stationed at strategic points along the borders or coast of a country at war. Then when enemy battleships, submarines or bombers came within five miles, the magicians could mumble a few magic words, and presto!—the invaders would be blown to bits by their own explosives!

An instrument has really been devised that will perform just such a feat, not by

[Continued on page 144]

DETONATOR RAY
TOUCHES OFF
FUEL TANKS AND
EXPLOSIVES IN
ENEMY BOMBER

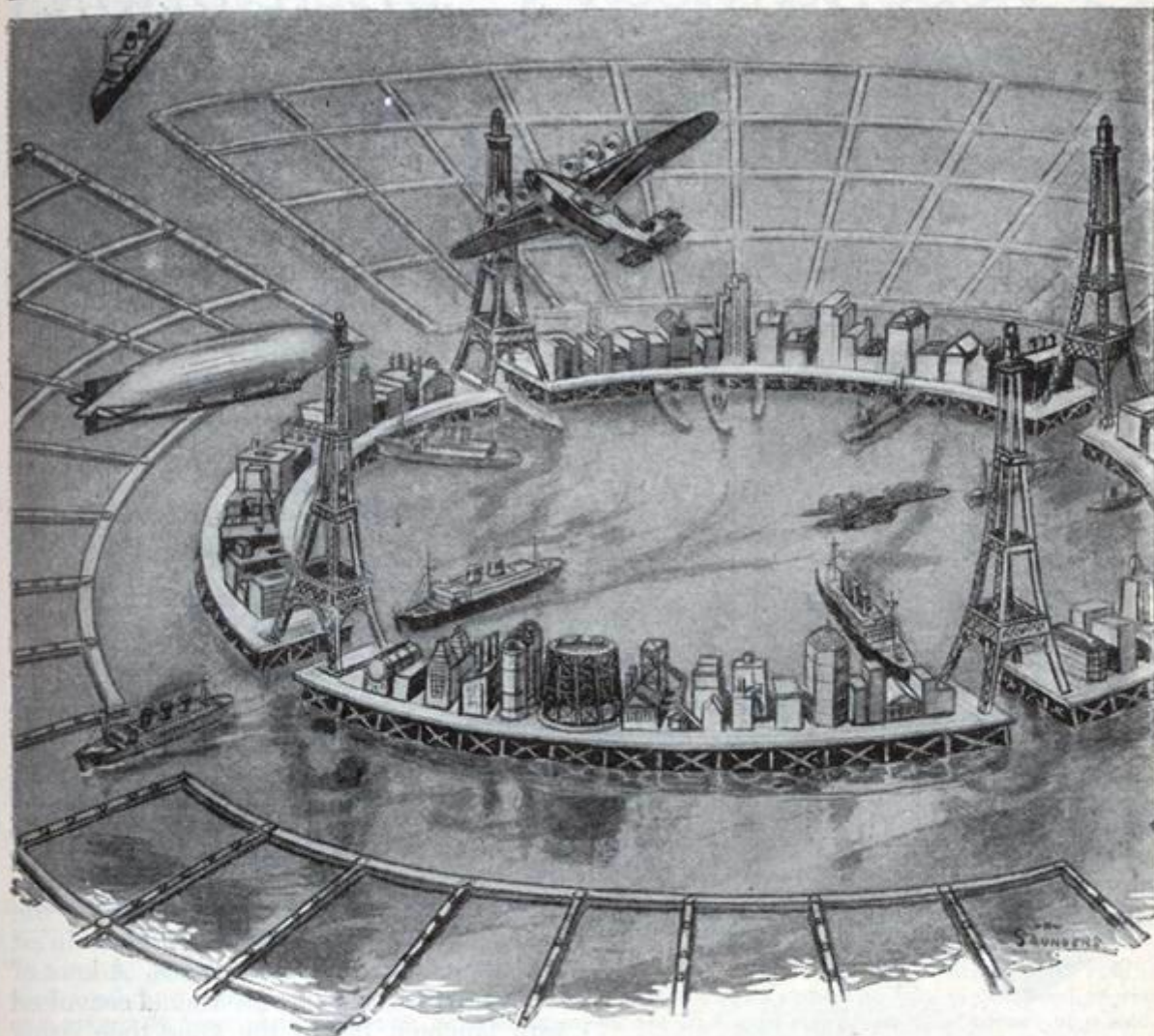
CONE SHAPED
ACCUMULATOR
PICKS UP AND
RELAYS SOLAR
RAYS TO SECRET
DETONATOR BOX

STEADYING
FIN

FOCUS
TUBES

EXPLOSIVES IN
TORPEDO CHAMBER
REACTING TO BEAM

French Engineer Plans Huge Floating Mid-Ocean City



The above drawing shows the model, built by a French engineer, of the proposed \$2,000,000 mid-ocean city to be established midway between Bordeaux, France, and St. Johns, Newfoundland. The outer steel network will act as a breakwater, and the harbor inside will serve as a trans-Atlantic hydroplane station.

WHEN the continents of the world have become overcrowded and trans-oceanic airplane travel is as common as travel by steamers at present, we may see the establishment of huge mid-ocean cities such as is shown in the above drawing, which illustrates the plans recently made by Leon Feoquinos, a French engineer of Marseilles.

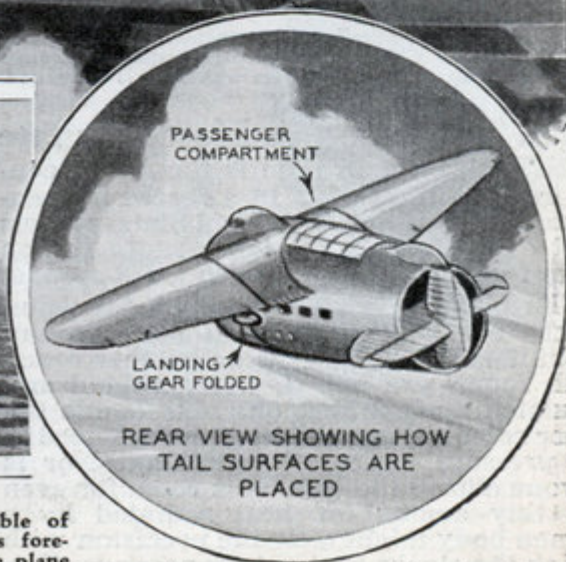
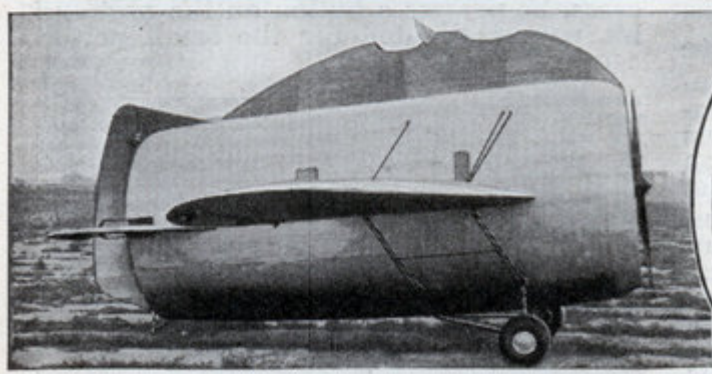
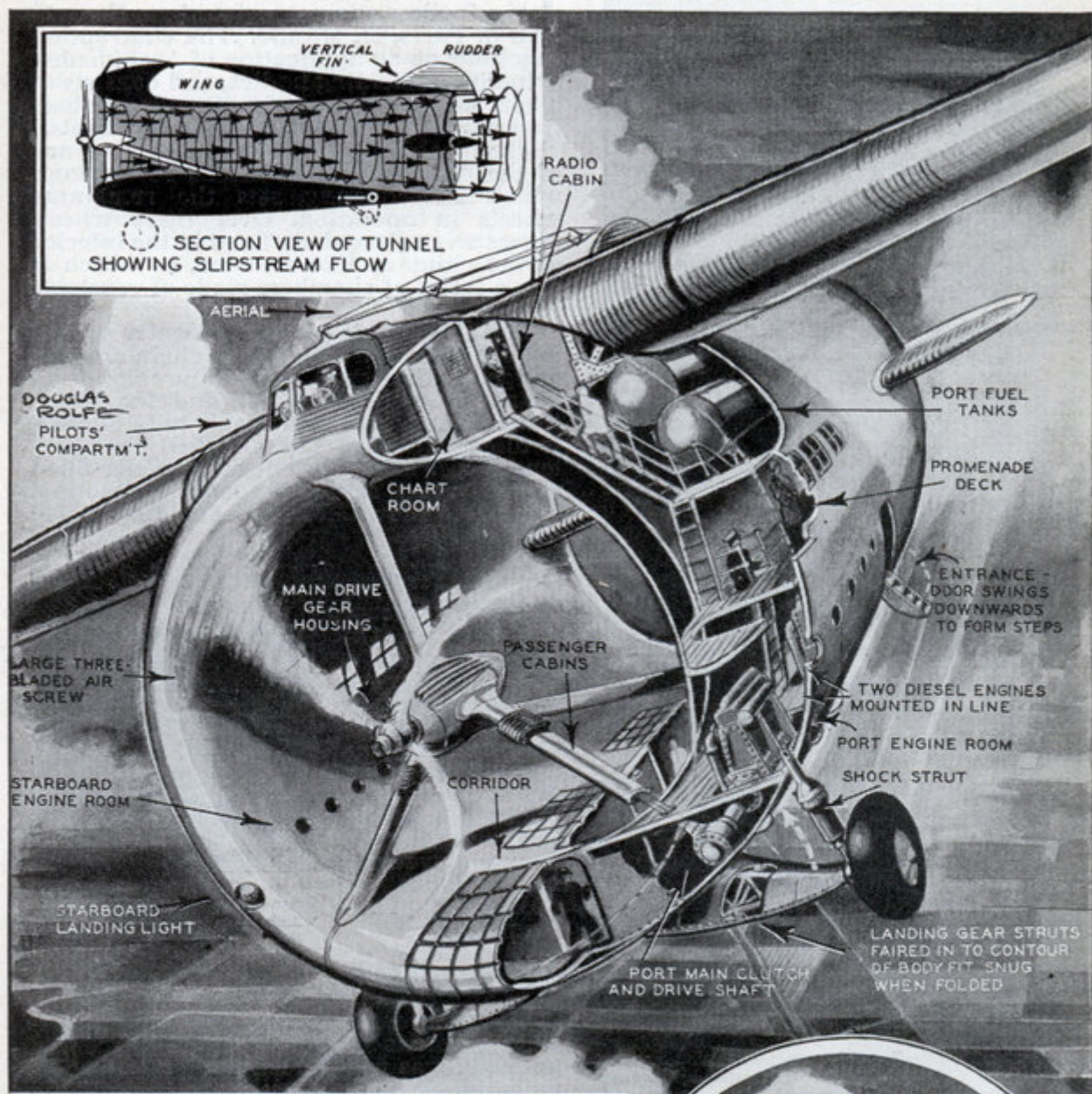
The foundation is to be a network of steel sections, held together with cables, to act as a gigantic breakwater against the heavy seas. In the center there will be a large enclosed harbor that will serve as a landing place for hydroplanes and a port for ocean liners. Later other features will be added, such as a spacious hotel, gaming casino, and four huge towers.

Liner Staircases Imperil Lives

THE wide staircases and spacious halls and passages of a great ocean liner may add to the attractiveness of the ship for passengers so long as nothing happens, but they may become veritable death traps if the vessel gets into trouble at sea and takes a strong list to one side or the other.

As the staircases are virtually unclimbable when tilted, members of the crew must carry passengers up from the lower decks, and in case of a rush to the boats many passengers, being unable to negotiate the stairway, may be left helpless to drown. Mr. E. F. Spanner, British merchant marine architect, has urged that several narrow stairways be provided.

Flying BARREL to Carry 100 Passengers



Development of a huge "flying barrel" transport plane capable of carrying a hundred passengers inside its thick tubular hull is foreshadowed by recent successful test flights of the hollow fuselage plane shown in the photograph directly above, designed by Engineer Stipa of the Italian Caproni works. The picture shows double cockpits placed on top of the cylindrical body, but in the refined version of the plane for large scale passenger traffic, the piloting compartment is faired into wing and propeller is driven through gears much like the dirigible Akron.

MODERN MECHANIX

MARCH

AND INVENTIONS

NOW
15^c

IN CANADA 20c



SEE PAGE 71

saunders

1000 WAYS TO MAKE A LIVING

How The Flying Saucer Works

If you haven't seen saucers yet, you will—and they'll be built to Air Force specifications.

By Willy Ley

Editor's Note: Ever since 1950 when TRUE The Man's Magazine discussed existence of flying saucers, the world press has been continuously interested in the flight possibilities of disc-shaped aircraft. The most recent Air Force report on flying saucers, issued in November 1955, states that there are rational explanations for practically all the so-called flying saucer "spottings." Most interesting portion of the Air Force report to many readers, however, was the section dealing with America's plans for building a disc-shaped aircraft capable of vertical flight and easy maneuverability. To bring you more details on exactly how such a craft would operate, we have asked the world-famed authority on rockets and guided missiles, Willy Ley, to visualize for us how the craft now under development for the U.S. Air Force might be constructed in the light of what is now known about jet propulsion and vertical flight. Mr. Ley's observations are based on conversations with VTO authorities in the U.S.

and on a lifetime of research in jet propulsion and rocket-powered flight.

EVEN the most devoted science news and science fiction readers were surprised by a series of official releases that enlivened newspaper reading last summer and fall. First there was the White House release about artificial satellites, to become a reality no later than 1957. Then came the Department of Defense "flying saucer" release, dealing not with machines from outer space manned by small green men, but with a product of terrestrial slide rules and American factories, to be flown by American pilots.

In the Defense Department release Secretary of the Air Force Donald A. Quarles was quoted as saying that AVRO Ltd. of Canada had a USAF contract to build an aircraft similar to the

Artist Gurney Miller's concept of a typical airport scene in the not-too-distant future: spectators at an Air Force saucer base are watching the takeoff of a disc-shaped, two-man interceptor. The aircraft in its vertical flight phase employs jet nozzles and Coanda flaps located all around its rim. With jet exhausts directed downward in this manner the flying saucer will be able to rise, descend and hover—giving it the safety and comfort factors of the modern helicopter. As soon as the saucer has reached a suitable altitude the pilot will shut off all but a certain number of the after jet nozzles, thus converting the aircraft to forward flight. In that phase the saucer will operate like any jet plane. Its stability will be achieved through the use of jet air intakes, visible above the rim of the saucer, as wing slots or internal vertical surfaces. Forward speed of the saucer in flight should be near the sonic. Landing pads for the saucers need be only slightly larger than the saucers themselves, but must be of material resistant to high temperatures.



popular flying saucer concept. In subsequent news articles journalists observed sagely that something called the Coanda effect, a new principle in aerodynamics, had made the disc-like aircraft possible.

Henri Coanda is a Rumanian who has lived in Paris for several decades. He has the distinction of having designed, built and flown a pure jet airplane as early as 1910. His ideas came to the attention of a British-American Intelligence team back in '45, when he was being questioned under somewhat embarrassing circumstances. The British member of the team, after hearing Coanda out, recommended to his government that it interfere in his behalf in case the French wanted to guillotine Coanda for collaboration with the Germans. Coanda's head, he felt, was more useful to the West on Coanda than in a basket.

Fortunately Coanda is still alive; there was no evidence that the Germans ever used the Coanda effect in any of their aircraft. In all fairness to this talented man, he had never made a secret of the effect that is named after him. In fact, he had gone to some lengths to publicize it, presumably in his effort to find backers.

To visualize the Coanda effect, let us first imagine a rectangular nozzle from which a high speed jet stream emerges. A metal flap placed in the way of the jet will obviously deflect it. But it will not last long under that powerful battering. Coanda found that a flap *below* the nozzle will also deflect it; the jet might be said to "cling" to the flap. It also sucks down external air with it.

The angle between the flap and the direction of the jet flow must not be too large; at a right angle to the jet it will only act as a drag on the aircraft. Coanda found that his effect worked only at angles under 31 degrees. The size of the nozzle is important; the effect is hardly noticeable with nozzles of less than three inches in width or with nozzles of more than eight inches in diameter. Possibly later research has corrected this finding. If not, it would seem that a full-size flying disc would need many small nozzles and flaps

to get up in the air and stay there.

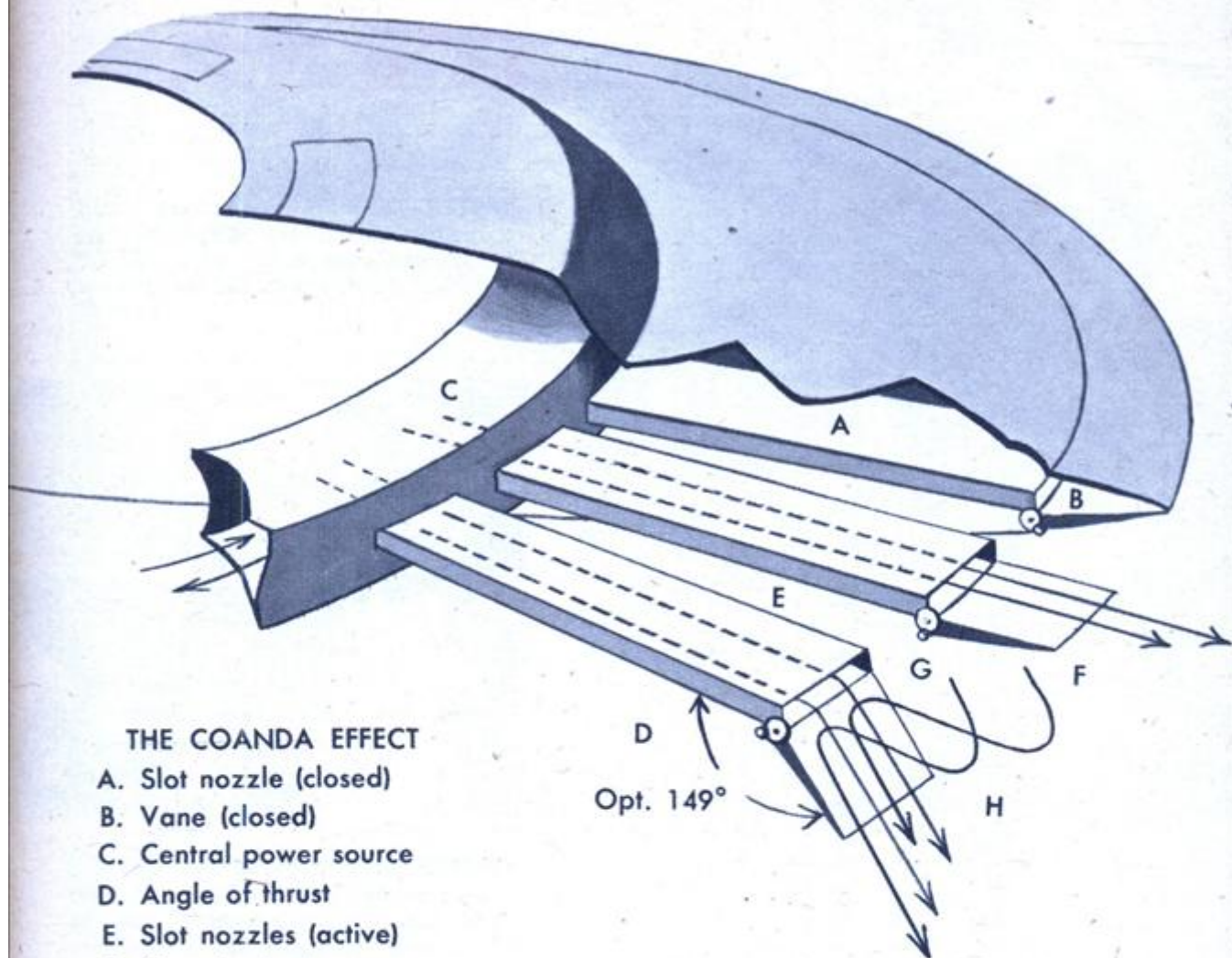
These would be arranged around the rim of the saucer, probably in a way that would almost hide them from the spectator. At takeoff the Coanda flap at each nozzle would be extended and tilted down at a 31 degree angle; then the exhaust would be started. There would be a downward component in each exhaust, strengthened by the external air sucked down with it. The saucer would rise from the ground; by adjusting the total jet blast the pilot could then hover or rise higher.

The takeoff pad for the saucer need be only a little larger than the saucer itself. Of course it must be made of a substance that is impervious to the jet exhaust; that is the main engineering problem involved.

At a sufficient height the pilot would simultaneously withdraw all his flaps and cut off all but about one-sixth of his exhausts. These would then act as conventional propulsive jet plants and the saucer would thereafter fly as a plane, according to the same laws of aerodynamics as any other jet.

There will be no difference between wing area and fuselage in this craft, and the absence of tail surfaces will make for poor stability unless compensating devices are used. One compensating method that has long been considered for aircraft of this type is a careful distribution of weight inside. This is known to give a certain amount of stability, but will probably be used in conjunction with some more effective method such as having jet air intakes that also serve as wing slots. The use of wing slots as stabilizing devices is nothing new in aerodynamics; many conventional or "powered kite" aircraft have used them in the past. The placing of the intakes will be an important matter.

So far there seems to be no advantage to the saucer except vertical take-off, which is obtainable in aircraft that are inherently more stable. So why bother with the saucer concept at all? The answer is speed—speed up to the sonic rate combined with slow, easy takeoffs and landings. During World War II, Chance-Vought built a plane called the V-173. The V-173 was horseshoe-shaped,



THE COANDA EFFECT

- A. Slot nozzle (closed)
- B. Vane (closed)
- C. Central power source
- D. Angle of thrust
- E. Slot nozzles (active)
- F. Vane (active)
- G. Outside air
- H. Jet flow from slot nozzle clings to vane, is joined by outside air

Showing how the jet nozzles and vanes will power and direct the saucers, using Coanda effect. Proven optimum downward angle for vertical flight and hovering is 31 degrees.

with props on each leg of the horseshoe. Theoretically it could do up to 400 mph, land at 35 mph. Its short takeoff should have made it ideal for a ship-based fighter. In spite of repeated Navy statements that the V-173 never flew successfully as a full scale aircraft, scuttlebutt has circulated ever since to the effect that it did fly and did achieve startling performance. Whatever really happened is still classified material. Chances are the plane fell down on stability.

Now this speed range should be available to the coming saucers with a good deal more thrown in for luck. The saucer will be a safe aircraft for all

its instability because of its ability to hover. It will undoubtedly start out as a fighter aircraft; how soon it will take over other kinds of aviation is purely a matter of guesswork. Let's see them build and fly one first, before we start computing fuel consumption per ton-mile and taking up other mundane considerations that plague the commercial aviation boys. The one thing we can be sure of is that the flying saucers are coming. They may be the answer to the prayers of air transport men and airport planners who dream of a plane with all the advantages of vertical take-off plus competitive forward speed. •

TOM MCCAHERILL REVIEWS HIS TEN YEARS OF CAR-TESTING

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

25^c
MARCH



U. S. AIR FORCE REVEALS OUR FLYING SAUCER

BURIED GOLD IN LOUISIANA • THE WORLD'S MOST FABULOUS GUN

IN ITS unceasing efforts to save lives at sea, the Coast Guard is developing the glider-boat rescue unit illustrated here. Towed by powerful aircraft, the device would be released over the scene of disaster. After gliding to the water, it would jettison its wings and tail and take on the function of a motor boat. Designers hope eventually to make use of the wings and tail of CG4A gliders, produced in quantity during the war. The craft will be built so that it can be hoisted aboard rescue ships arriving upon the scene. •

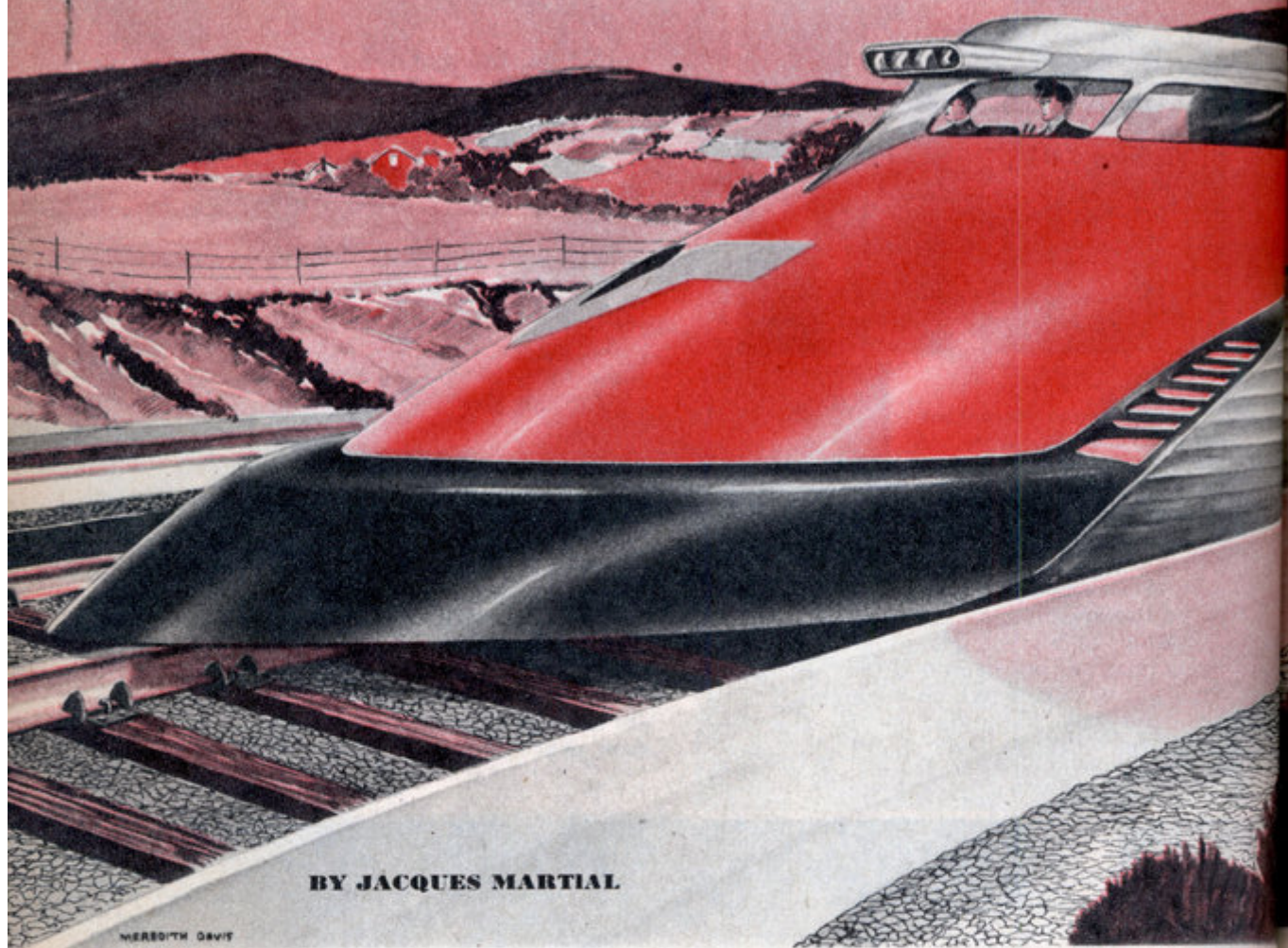
Right: Comdr. R. D. Schmidtman, USCG, with model. Below: Conception of rescue plan at work.



Glider-Boat



Grow Up, Railroads!



BY JACQUES MARTIAL

MEREDITH GAVIT

Designs by Martial and Seull, Industrial Designers

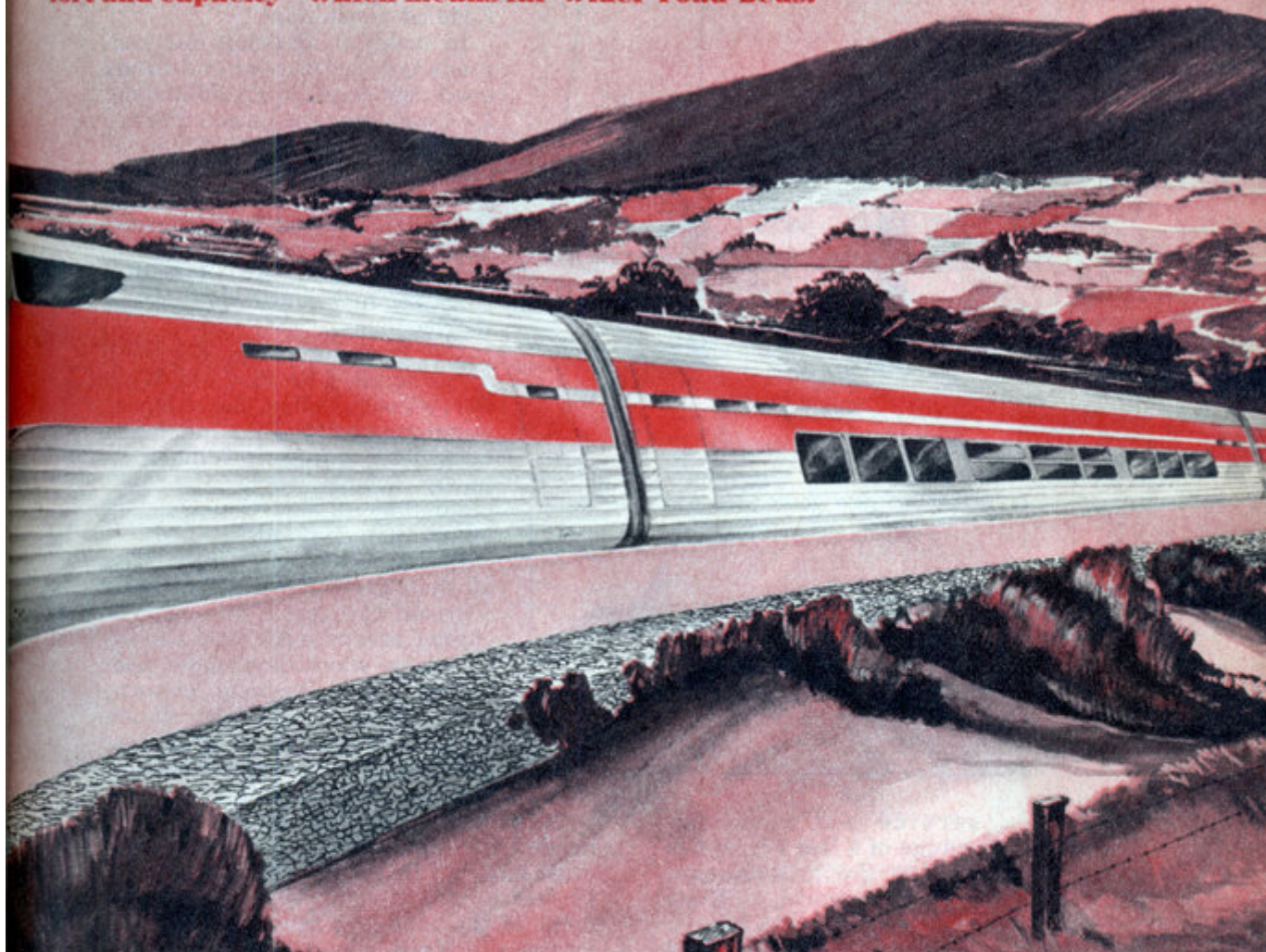
THE year 1869 was a fateful one in the history of railroads. It was during that year that George Stephenson won the "Battle of the Gauges" over his opponent Brunel, the famous engineer of the Great Western Railways.

This "victory," which decided in favor of the narrower gauge of 4 feet 8½ inches, was a fundamental error. From it stem practically all the ills of the present-day railroads. Greater speed, cost of operation, volume, comfort, loads, economy—every possible progressive step needed today is prevented by the initial shortsighted decision won by Stephenson. History is not clear as to how the odd figure

of 4 feet 8½ inches was arrived at. Some say it was based upon the distance between the Romans' wheel ruts. Others claim that Stephenson simply found it in the distance between the wheels of his own cart.

Brunel's original design for the track of the G. W. R. was 7 feet, and when the fateful decision was made 1,500 miles of broad gauge was already in existence. Brunel had obviously visualized future progress of rail transportation and claimed rightly at the time that by using his wide gauge he was able to have a more powerful locomotive and therefore greater [Continued on page 74]

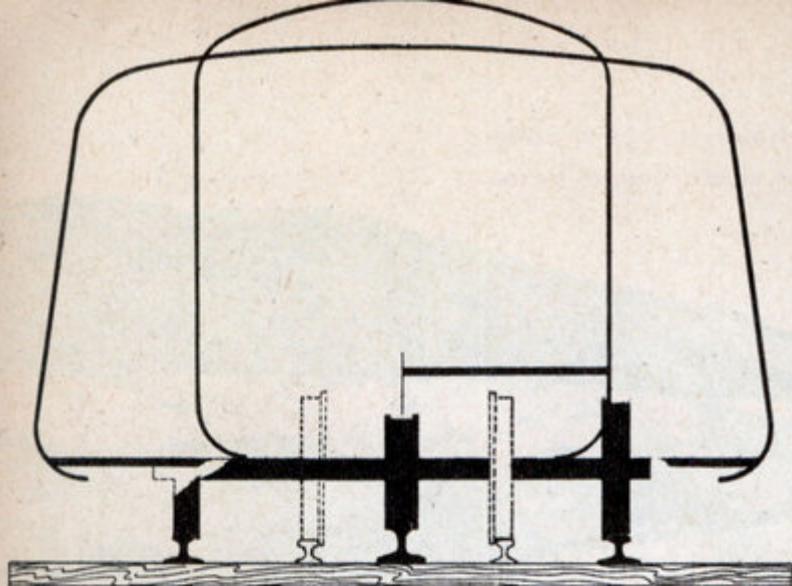
Tomorrow's trains must have much more speed, comfort and capacity—which means far wider road-beds.



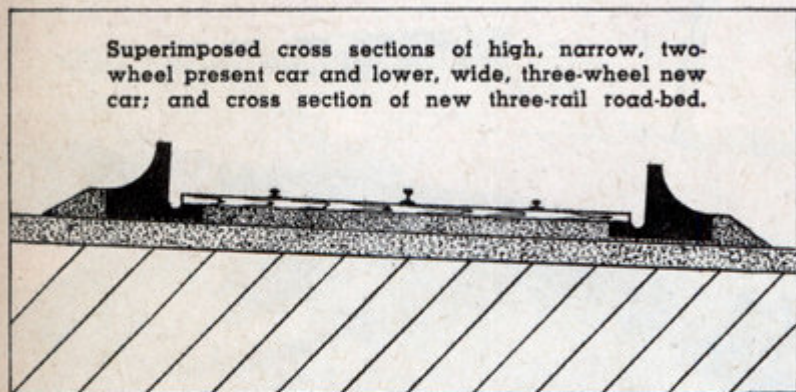
Most-modern of present car designs are these GM double-deckers topped with their wide-view astra domes.



November, 1947



Superimposed cross sections of high, narrow, two-wheel present car and lower, wide, three-wheel new car; and cross section of new three-rail road-bed.



speeds, loads, service and economies.

The narrower gauge of 4 feet 8½ inches has stuck. It is today the international standard used all over the world, with the exception of a few countries who have a wider gauge, such as Spain and Portugal with gauges of 5 feet 5¾ inches, Russia largely with 5 feet, Eire with 5 feet, and the main lines of India with 5 feet 6 inches.

With this narrow track railroad engineers have already attained the maximum of possible results. On American railroads—without doubt the best and most efficient—top speed has reached about 130 miles per hour. The cruising speed of the best light stainless steel trains is approximately 80 mph.

This speed, which would have seemed fantastic to George Stephenson, is today slow compared with those of airplanes and is totally inadequate for the future development of the railroads. It is an inescapable fact that to develop modern railroads to fulfill present and future demands we need speed up to 250 mph—and this can't be obtained on the present tracks.

Of course, to reconvert all our lines to a broader gauge would be costly and

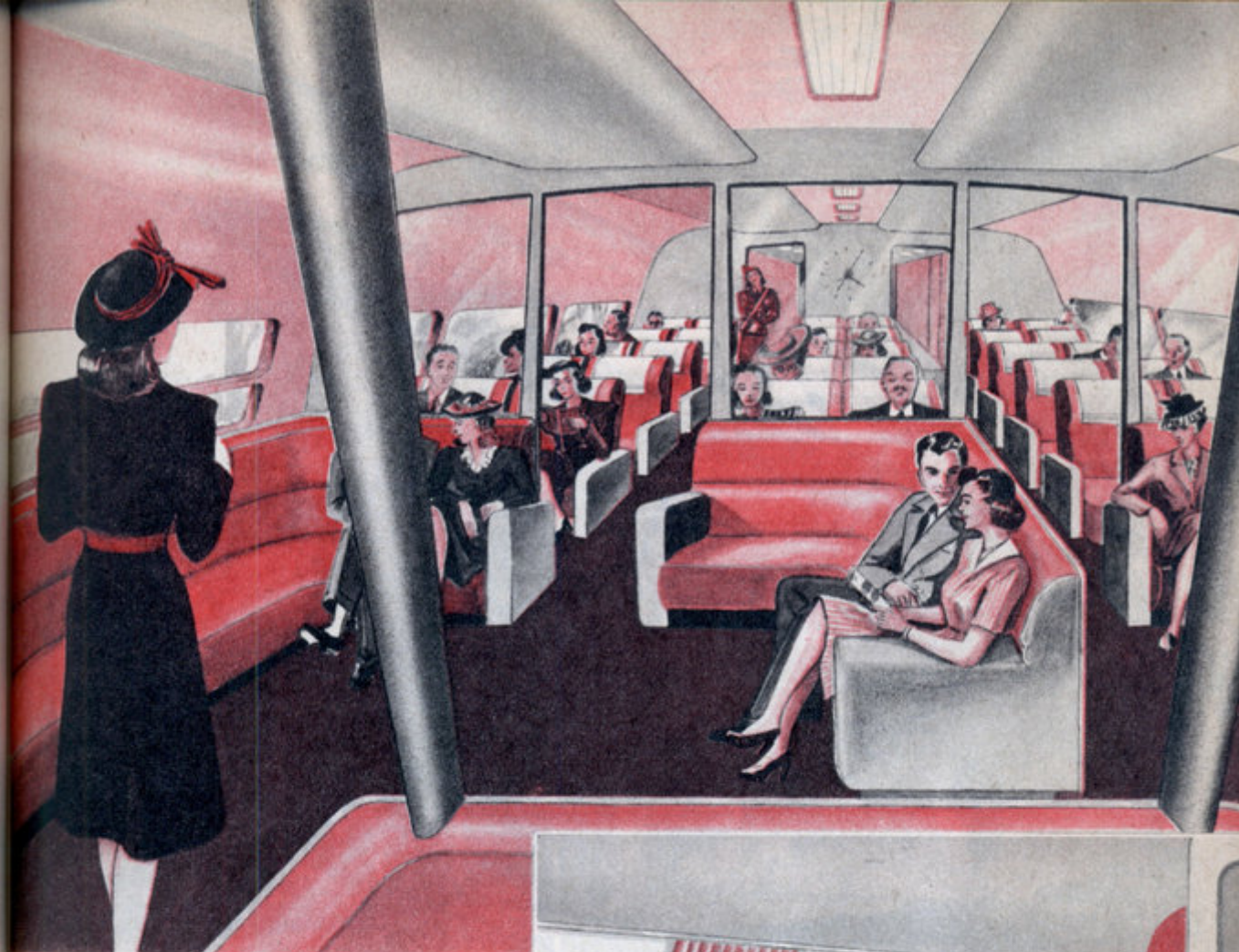
difficult, but it could be done under a progressive program. Conversion would have to be done on a national scale with Federal assistance.

In order to develop our railroads to meet present and future needs we must do the following: 1, Complete the electrification of all the roads. 2, Widen all tracks beginning with one double track from North to South along the Atlantic coast and one from East to West on a central line. 3, Design and build rolling stock for high speed and greater service loads.

The present steam engine is as antiquated as the old Wells Fargo coach. The diesel engine dominates at present but it can be widely improved. Tomorrow's power is sure to be electricity created by numerous electric and atomic power plants.

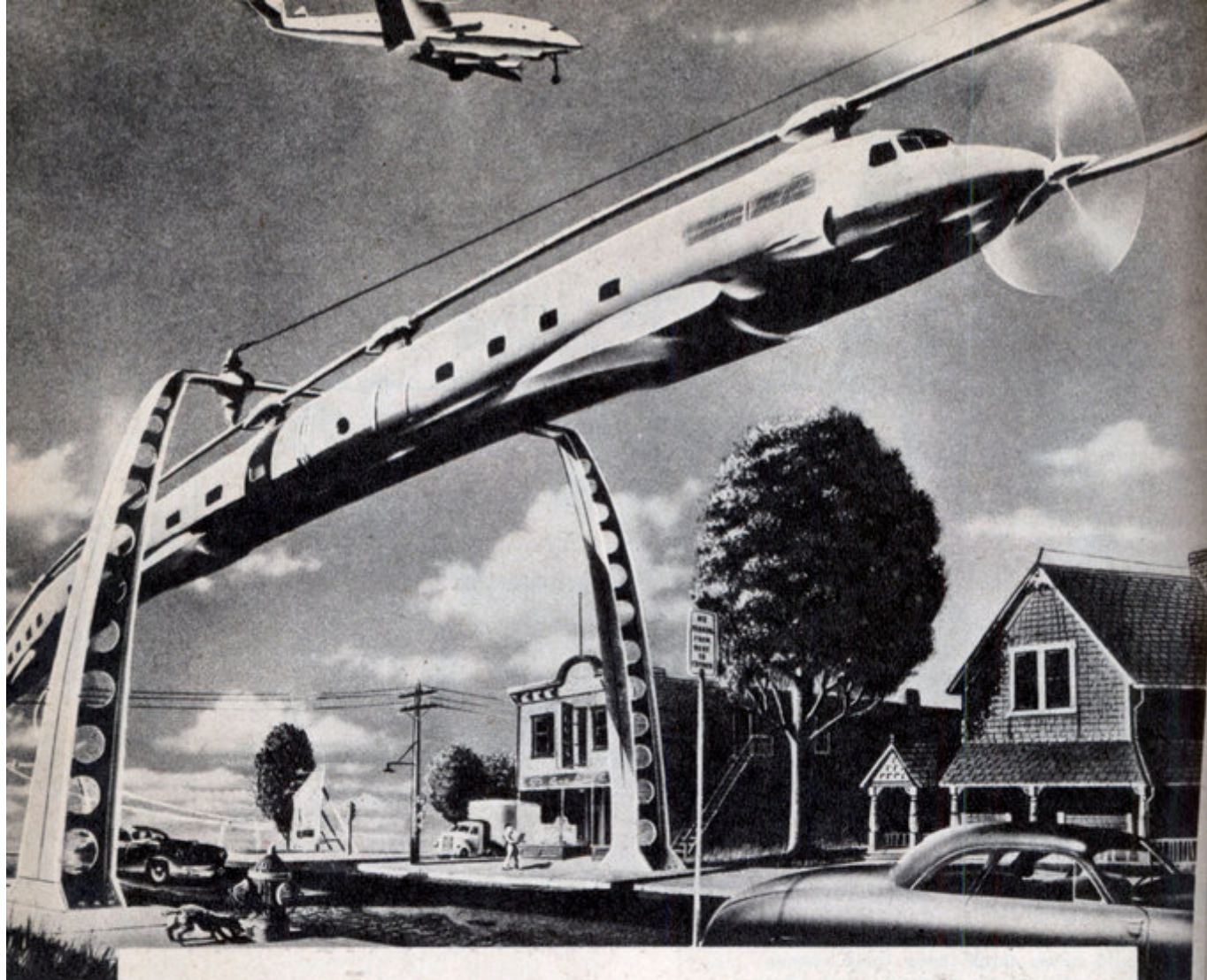
Railroad designers now have all their ideas compressed within a prison of 4 feet 8½ inches and cannot escape. All they can attempt is what they have been trying lately—vertical expansion, which means the double decker. But where does this lead us? Straight to speed reduction! It is no solution at all.

Let's have a look at the new designs needed for high-speed trains. First, we must have a rail gauge of something like 10 feet with a 3-rail track. Reinforcement of the road-bed may be necessary, or the rail itself may be made bigger—10 to 12 inches—to carry the heavier loads. The line should be as straight as possible, with inclinations proportionate to the new high speeds. The present car height should be reduced from 13 feet to about 11 or 11½. The present 40-inch wheel could be retained if technical improvements are made. Roller bearings must be used, and strength added. The car floor should be lowered from four to about two feet above the top of the rails, which means it will have to rise above the trunks; this will be but a small inconvenience to passengers, however, if the rise is graded smoothly. By lowering top and floor we lower the center of gravity. Also, lowering the top permits the proper speed line. The width of the car could be then increased to 18 feet at the base and tapered to approximately 13 or 13½ feet at the top. The front of the engine would be given a graded slope at least 16 feet long in order [Continued on page 76]



You'd never think these three scenes were interiors of railroad cars! But this is what comes with a rail gauge of ten feet—room—plenty of room—a thing the cars of today have practically nothing of. And the new cars won't lurch—so you won't be a menace fighting your way through the diner!





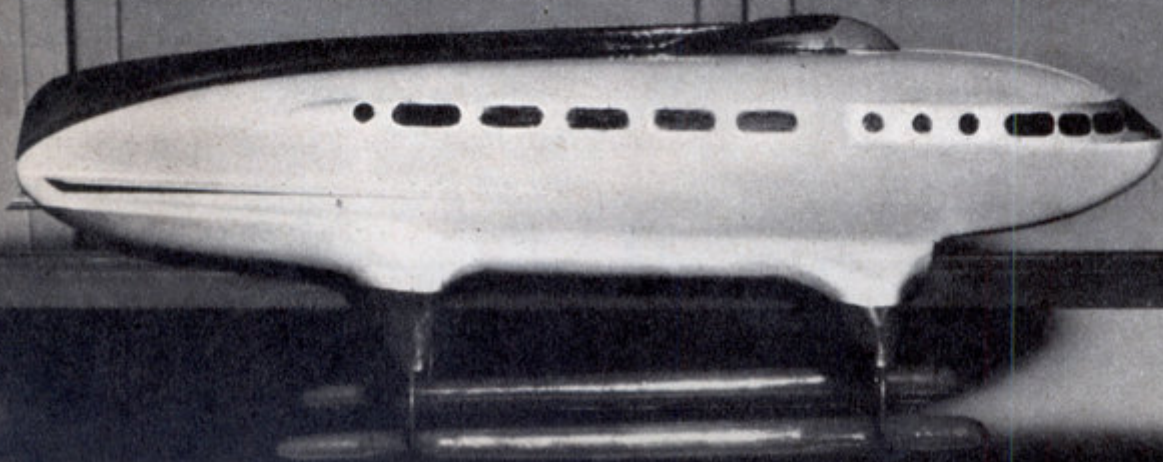
to bring increased pressure to bear on it and so keep it firmly on the rails at high speeds.

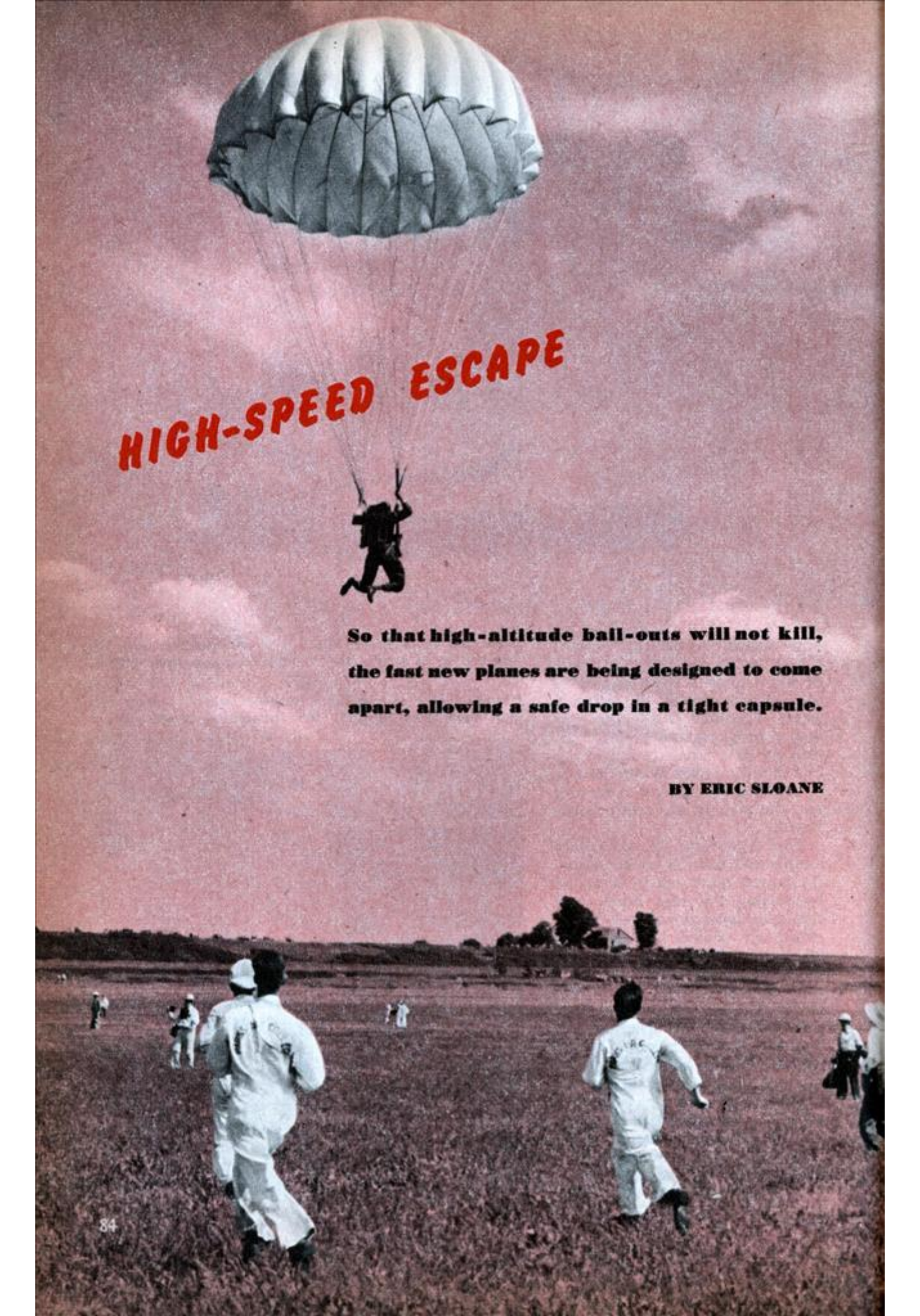
Such a car would have a serviceable inside width of 18 feet, eight more than the present ones.

Design possibilities are manifold.

Travel by rail would have comfort and luxury like that on crack ships. •

Proposed monorail railway will give speeds of 100 mph up, without hindrance to surface travel—and even be built over auto highways. Car below, powered by a jet engine, will do a safe 400.





HIGH-SPEED ESCAPE

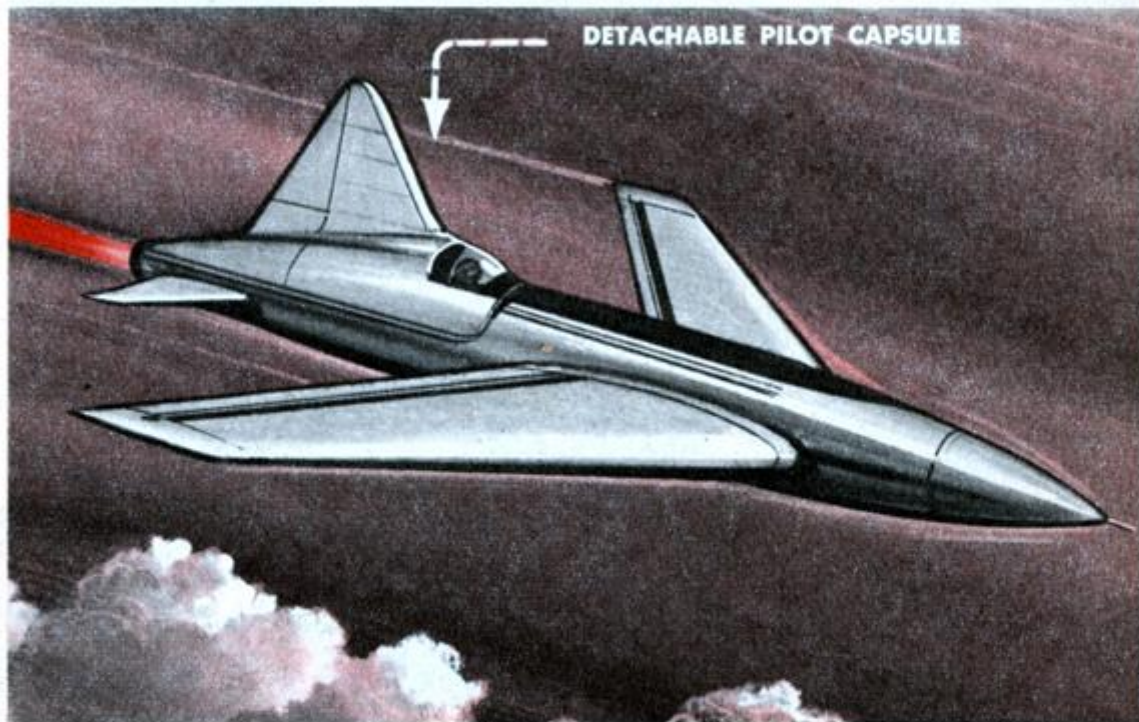
So that high-altitude ball-outs will not kill, the fast new planes are being designed to come apart, allowing a safe drop in a tight capsule.

BY ERIC SLOANE

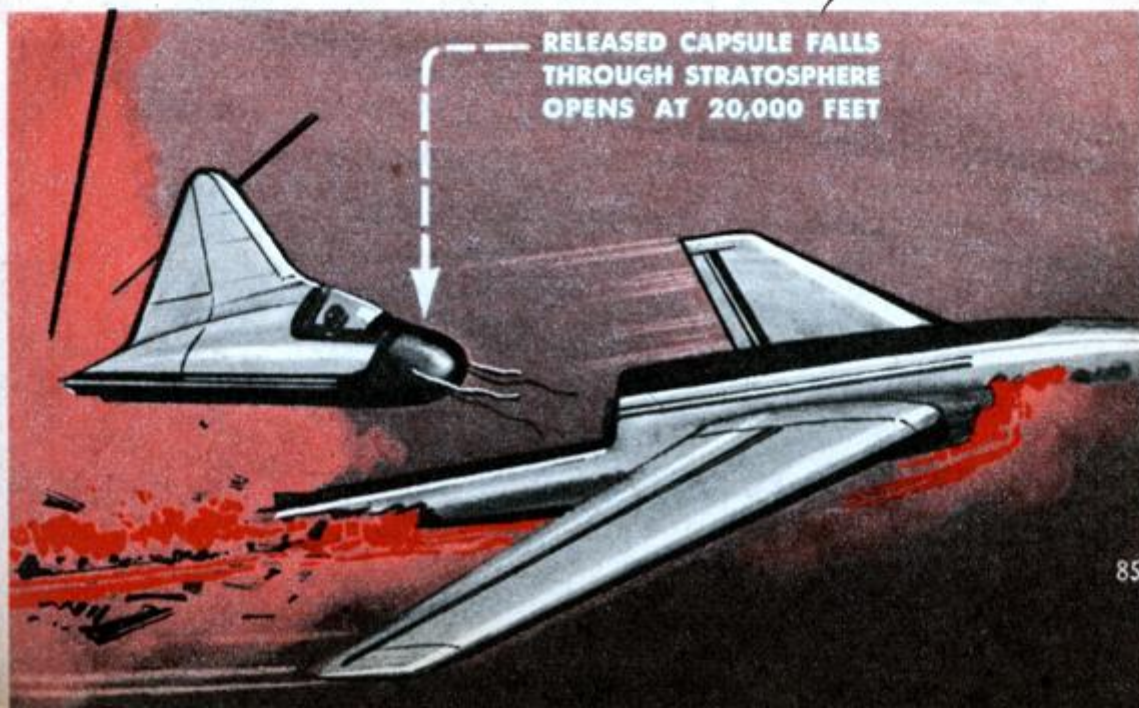
AT 60,000 feet the flyer's plane becomes his cell of life, its equipment almost as important as his own body. Outside the plane the cold of space is of instant-freeze intensity, much colder than any thickness of clothing could protect from. It is so thin that an exposed human's body would cease to function. Blood would boil there at body temperature. Death from oxygen lack would occur quickly. Accordingly, the high-altitude plane has a cabin pumped with high-pressure air. Heated clothing is plugged into the plane's power line. The flyer's lungs are con-

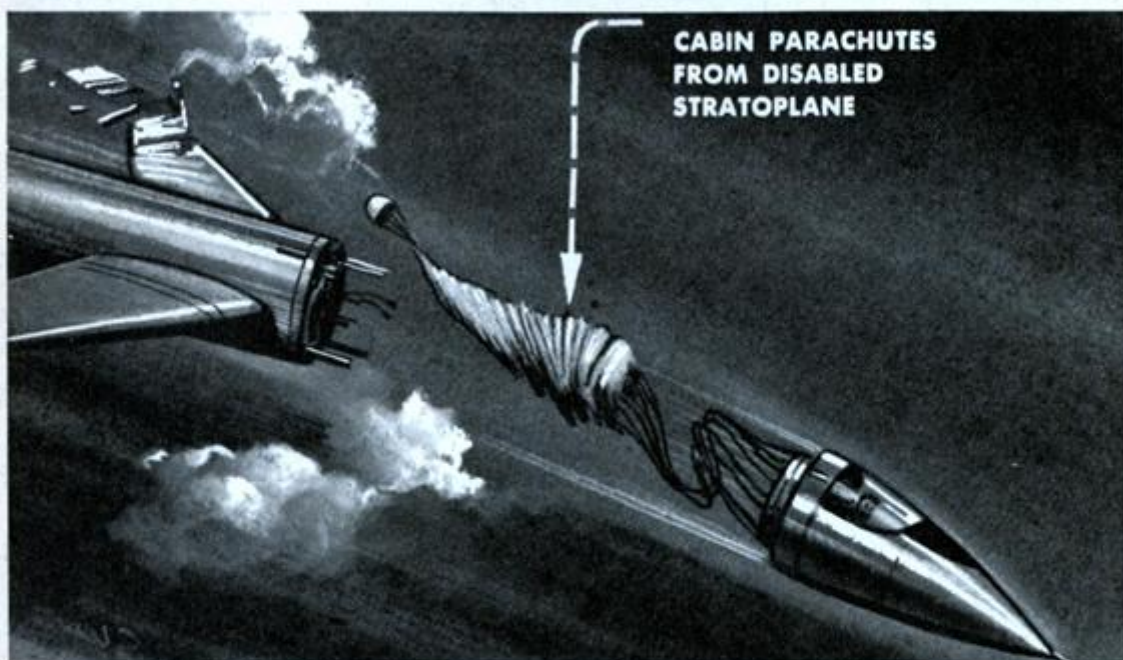
nected directly to the ship's oxygen supply by means of a mask. To abandon such a design for living at 60,000 feet would be like leaving behind the most important organs of the body. Yet if things go wrong with the high-altitude supersonic ships now being designed, it may be necessary to abandon ship at stratospheric heights. What then to do?

Even at 45,000 feet (today's flight ceiling) a flyer cannot safely parachute from his ship. No flyer in his right mind would bail out from great heights when he can ride his ship to safer levels first. It would take a parachuter about a half

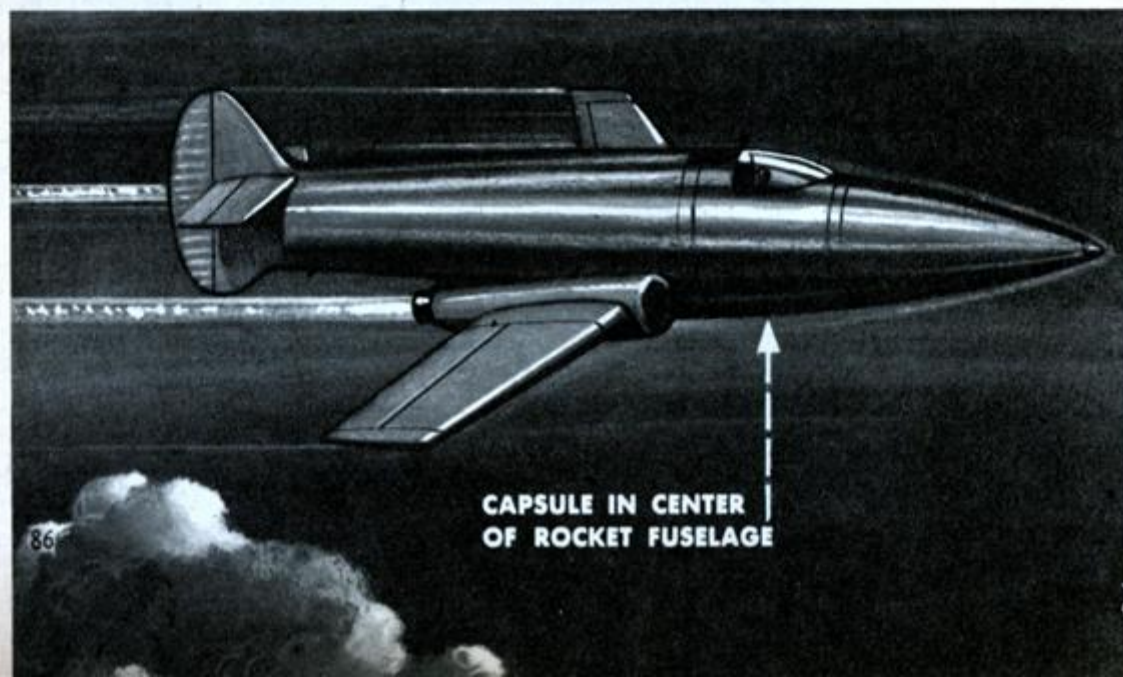


In an emergency the pilot's capsule is detached and parachutes downward; then, at a safe altitude, the pilot jumps out and continues on down, using his own parachute.





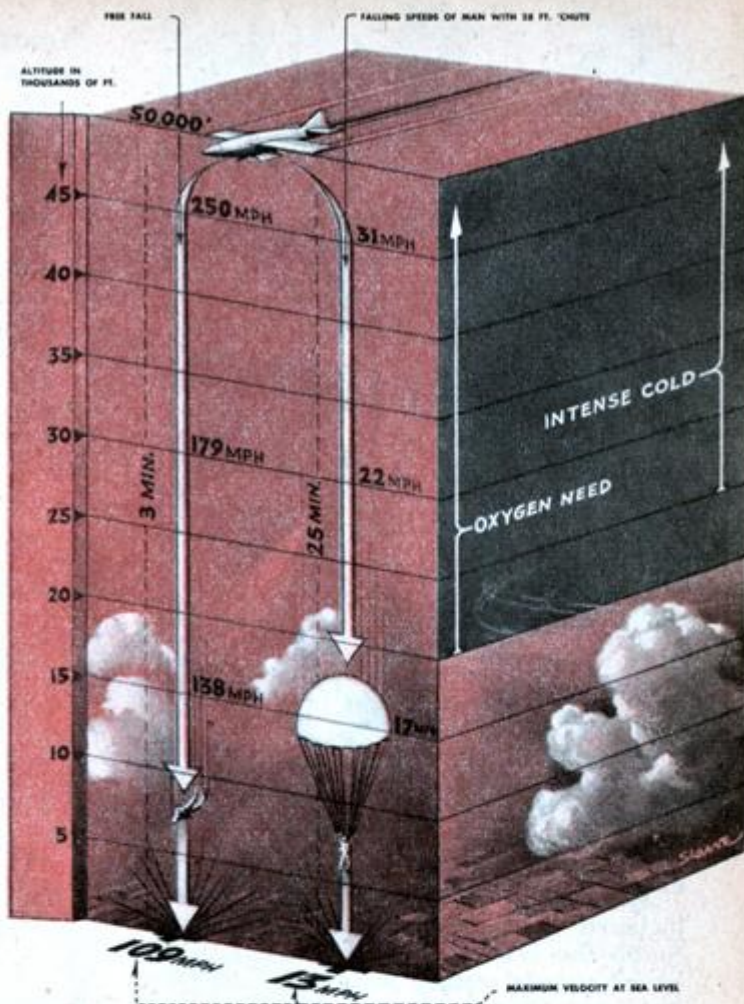
Top drawing shows the capsule as located in the nose, and just below we see it right after being detached, its parachute beginning to open, the pilot safe in his pressurized cell until it's time for him to jump free. Below and across the page we see the centrally-placed capsule, which requires detaching by means of explosive rivets.



Any pilot who bails out at 50,000 feet dies on the way down. Only a capsule will let him fall safely.

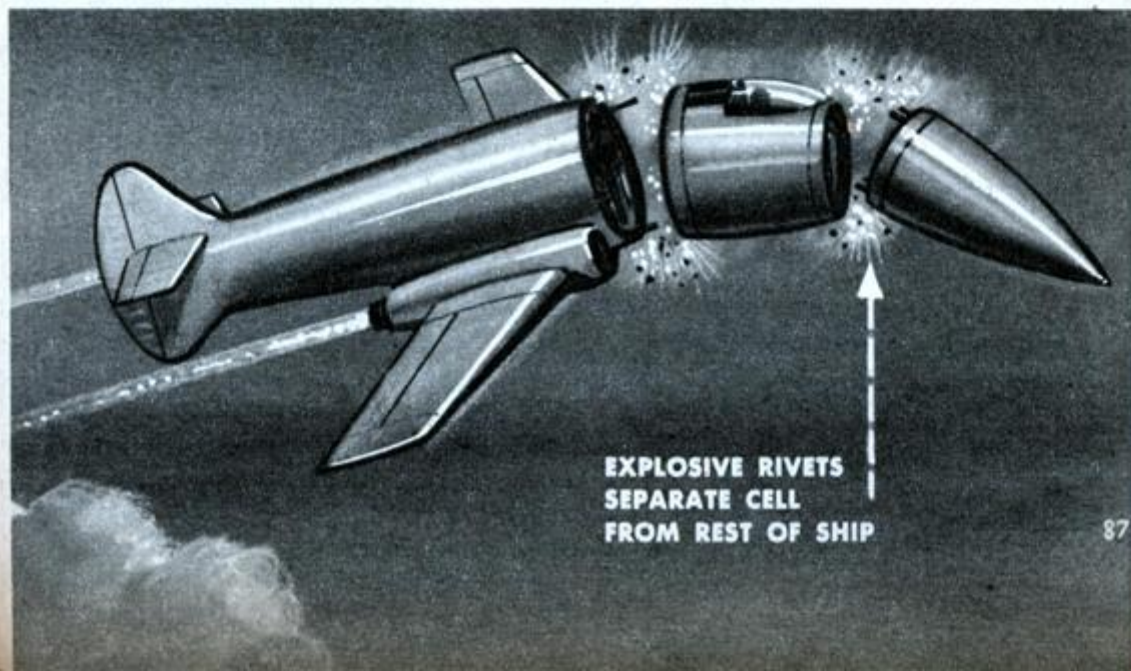
hour to float to earth from 50,000 feet, time enough to make the trip fatal. The trick is to fall free—about a three-minute trip—through the deadly thin air, then open the 'chute at about 10,000 feet. Of course you would have to carry a portable oxygen bottle for even that short fall through the dangerous area. It is interesting to note how the body falls slower as it approaches the denser air near the earth. Although you would fall at 275 mph from 50,000 feet, you would strike the ground at only 109 mph. These speeds are maximum velocities for the man of average weight. In the chart, the darkened portion is that area to be dropped through at the greatest speed—where cold and thin air mean death within a very short time.

Another stratospheric parachute difficulty is the yet unexplained shock experienced at the 'chute's opening. One would think that the greater speed would be counteracted by the thin air, but no. The shock of opening a 'chute at high altitude often reaches 40 G's! Even at low altitudes, if you opened your 'chute at 400 mph you would add 6,000 pounds to your weight; not only would your



body break, the 'chute would, too. Only a closed cell or "capsule" could protect the flyer when abandoning ship either at supersonic speeds or at great heights. A ribbon-type chute would then be reefed out until the capsule has slowed down to normal falling speed, then allowed to blossom to full size.

The drawings show three [Continued on page 162]



TELEVISION IN YOUR HOME NOW FOR \$159.50 Complete



This easy-to-assemble kit plus a few hours time gives you a highest quality television set . . . at only half the price you'd pay for the lowest priced set on the market!

Designed by television experts, this kit contains everything . . . dipole antenna, 7" picture tube, pre-tuned R.F. unit . . . even solder! Nothing extra to buy. All you need is a screw driver and

soldering iron. Assembly instructions are non-technical and simple to follow. All complex units are pre-assembled and tested at the factory.

EQUALS HIGH-PRICED SETS IN PERFORMANCE

Perfectly focused, clear picture even in brightly-lit room. Over 6,000 Transvision sets assembled by novices are in perfect operation today! Each set has an unqualified guarantee. Order one now and see the ball games in the comfort of your living room!

BEACON TELEVISION, Inc.,
Distributors for Transvision Television Kits
143 East 49 St., New York 17, N. Y.

Beacon Television, Inc.
143 East 49 St., New York 17, N. Y.

M-7

Gentlemen:

- ☐ I'm interested in your easy-to-assemble Transvision Television Kit. Please send me more information.
☐ Please send me a Transvision Kit at once at \$159.50. Enclosed is my check (or money order) for \$25.00 as deposit. Ship it C.O.D., F.O.B. New York and I will pay balance on delivery.

Name _____ Street _____

City _____ State _____

This is the way to Make Money!

MACHINE SAW FILING with the Foley Automatic Saw Filer is the modern way to recondition saws. Anyone can do the work—no experience needed—no eyestrain. Start in spare time—Foley-filed saws cut so smooth and fast, they will advertise for you, bring you new customers and a steady repeat cash business.

The Foley is the **ONLY** machine that files all hand saws, also band and cross-cut circular saws, enables you to handle work from schools, shops and factories as well as farmers, carpenters, etc.

Send for FREE PLAN

Shows how to start—no canvassing. You can get a Foley Saw Filer now. Send coupon today.



"I bought a Foley Saw Filer, one year later had all debts paid and also \$400 on a new home. Many days I earn as much as \$16," says J. H. Kellogg

W. L. Tarrant writes: "I left my old job last September and in 10 months have filed 2,159 saws. We have a lovely business worked up and cannot keep up with the work."

Thor Nedribe, Iowa, says: "I have filed 550 saws, made \$350. As I'm a carpenter, I just file saws in spare time—have more than I can take care of."

FOLEY Automatic SAW FILER

FOLEY MANUFACTURING CO.
715-7 Foley Bldg., Minneapolis 13, Minnesota
Send Free Plan on Saw Filing business, no obligation

Name _____
Address _____

Race to the Planets

[Continued from page 112]

upon the human body has already been studied. It is found that the body is not affected by velocity, but by too violent acceleration. The space ship will be designed with fully controlled propellants so that the rate of acceleration is not permitted to impose a fatal strain upon the occupants. Again, the use of atomic power should permit of a gradual building-up of the acceleration, with no adverse effects upon the astronauts.

The British Interplanetary Society is over 300 strong, composed of engineers and scientists, in distinction to now-defunct similar organizations consisting of dreamers and theoreticians. Work on space travel is kept at a high pitch. Come what may, they are resolved that the lunar equivalent of Paul Revere will some day shout, "The British are coming." American rocket workers they dismiss with a smile, as toiling in an unscientific fashion. They describe the Americans as building rockets first, firing them, then wondering why they went wrong. They are not intimidated by United States Army Air Force missile experts who are quoted as saying they expect to be able to shoot a rocket to the Moon within 18 months.

British rocket men point to British achievement in radar and other developments, considered by the uninitiated as pure U. S. inventions, and feel that their lead in space travel should be taken as a matter of course.

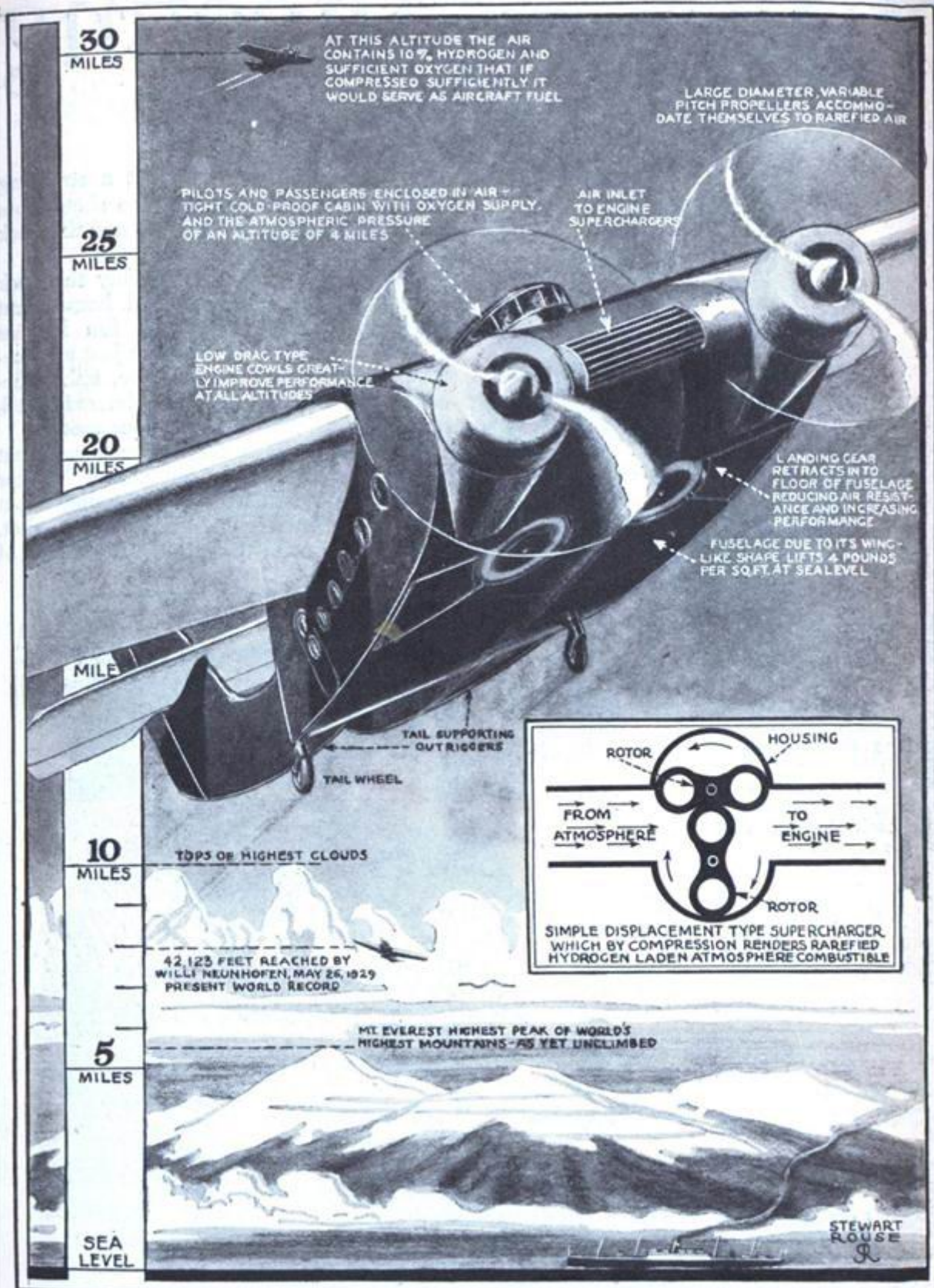
Whether the first space ship to land on the Moon will be British or not remains to be seen. Whatever happens, man is certainly no longer Earth-bound. How far in the universe he will eventually travel, no one living today can guess. •

High-Speed Escape

[Continued from page 87]

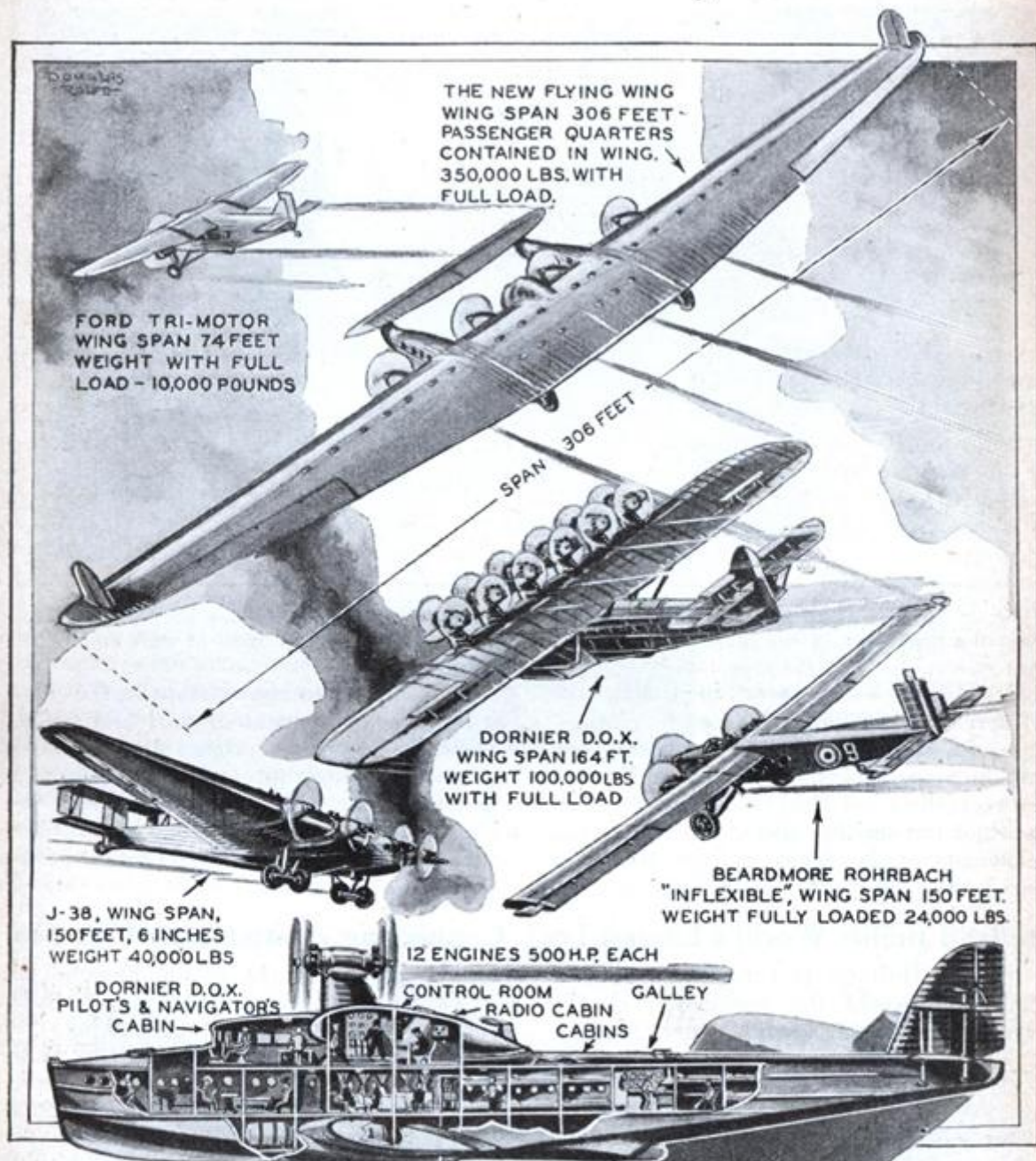
ways that the designers are considering to release a pilot's capsule into the stratosphere. The cabin cell could be released from either nose or tail position to parachute downward; then at lower altitudes the flyer could easily leave the capsule and use his own 'chute. Or, explosive rivets may be used to disattach the cell from the rest of the plane. Inasmuch as the cabin of the stratospheric ship must necessarily become an air-tight cell, the separate and detachable capsule becomes an easy job for the designer to plan. At present there are many thousand-mile-an-hour rockets on the designer's boards, and each design includes such a capsule. A new kind of aeronautical engineer has been born—the pressurized capsule expert. The world looks to his genius to send the first human into the space between the planets. •

Airplane to Run on Hydrogen from Air



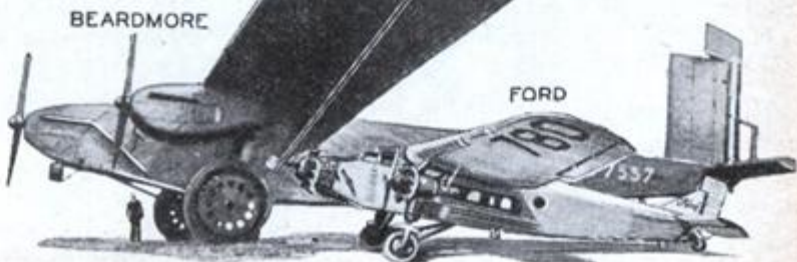
Flying at a height of 25 to 30 miles, an airplane being planned by Professor Rondine, of the Department of Aeronautics at Leningrad University, Russia, is to take the hydrogen which exists at these altitudes and use it for fuel. Professor Rondine proposes to equip his plane with a compressor to catch the thin hydrogen laden air and condense it to a point where it becomes a good fuel.

LEVIATHANS of the Air



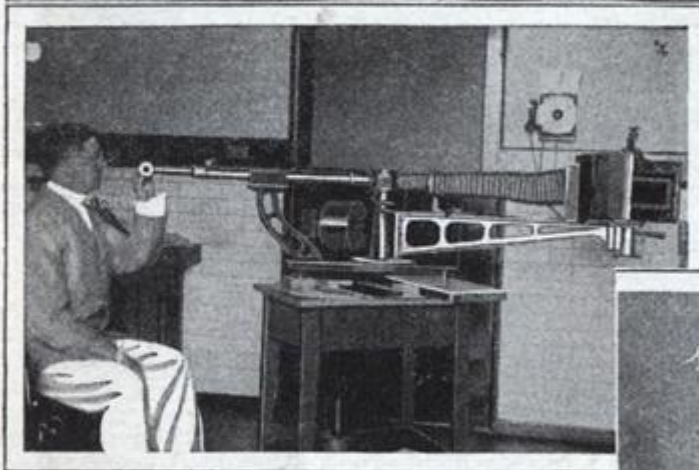
A comparison of the world's largest planes, showing how Europe is forging ahead in the design of air liners.

GERMANY, forbidden to construct military planes, has turned her attention to commercial craft. The world had no sooner recovered its breath from viewing the Dornier "DO. X" than Junkers announced a plane which would carry 175 tons.



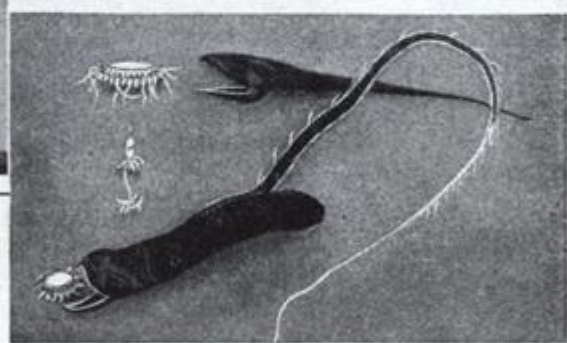
Above is shown how America's largest ship, the Ford Tri-motor, compares with Britain's giant Beardmore Rohrbach "Inflexible."

LUMINESCENCE *Still*



Photographing a firefly by its own light. The insect is placed in a glass receptacle and held before the camera.

Revolving beams of light as observed in the Strait of Malacca. This picture is redrawn from a sketch by Captain Gabe, published in Nautical-Meteorological Annual of the Danish Meteorological Institute for 1910. This strange phenomenon was observed in 1909.



Luminous jelly fish being devoured by strange deep-sea fish equipped with whip-like phosphorescent appendages.

ON DECEMBER 28, 1929, the British steamship *Talma* was off the eastern shores of the Bay of Bengal, en route from Calcutta to the Far East. The weather was calm and clear. Toward seven in the evening an extraordinary display of luminosity was seen in the surrounding sea.

"At first," says the captain's report, "what appeared like small globules of phosphorescence rising from below and breaking at the surface were observed. Later these assumed an appearance almost like flashes of lightning under the water, which rapidly formed into regular beams, curved as the curved spokes of a wheel might be, and of a width at the ship of about 30 feet.

"These revolved rapidly from right to left at the rate of two a second—timed as the beams passed the bridge—around a distant center, which could not actually be seen clearly but appeared to be about five miles off.

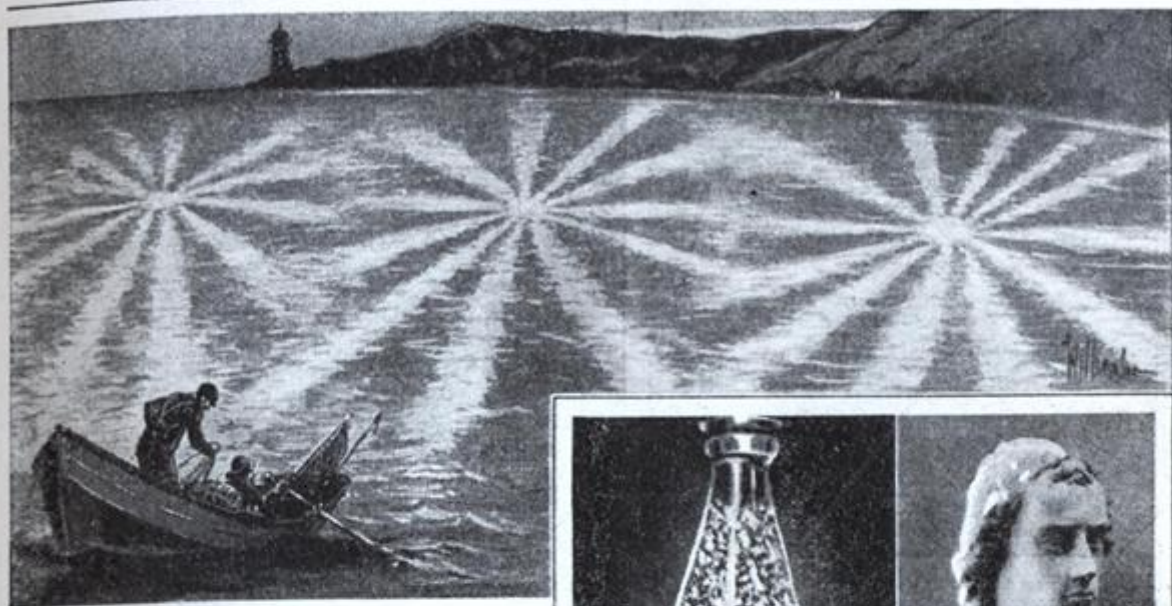
"This center passed ahead of the ship, being first observed on the port beam, and

from there drawing slowly ahead of and across the bows of the ship, fading gradually till on the starboard bow, when the whole phenomenon disappeared about fifteen minutes after it began."

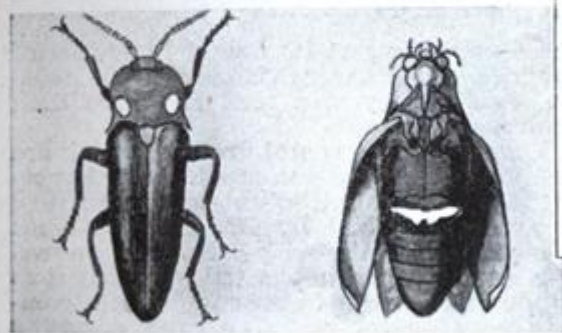
Here is a tale that science would dismiss as a mere sailor's yarn, but for one reason—very similar appearances have been reported many times in and about the Indian seas; especially in the eastern part of the Bay of Bengal and the adjacent Strait of Malacca.

A case almost identical with the one seen from the *Talma* was observed in 1909 from the Danish steamship *Bintang*. In other cases revolving systems of beams have been seen on both sides of a ship at the same time. In one case the beams reversed their

Mystery to Science by CALVIN FRAZER



Luminous wheels in the Bay of Bengal as observed from the British S. S. Arracan at 2 a. m., December 19, 1927. This picture has been redrawn from a sketch by wireless operator M. Goodman which was published in the *Marine Observer* (London).



The well-known firefly of the United States is not the only luminescent insect. These two are common in the tropics.

direction of rotation during the observation.

The beams are generally described as curved, with their concave sides in the direction toward which they move. Most of the displays reported have lasted only a few minutes.

In its ordinary manifestations the so-called phosphorescence of the sea is, of course, a very familiar spectacle and its cause is well understood. It has nothing to do with phosphorus—hence science prefers to apply the term "luminescence" to this and other varieties of light that are accompanied by little or no perceptible heat—but is due to the presence in the water of light-bearing organisms that are to the ocean what glow-worms and fireflies are to the



The photograph at the right was taken by the light from this glass jar filled with gelatine on which glow luminous bacteria. The jar is known as Dr. Molisch's Bacterial Lamp.

land. It seems, however, quite impossible that these creatures should travel in the water in such a way as to produce the effects just described.

A more plausible assumption is that these apparent evolutions are not due to actual movements of the luminescent organisms, but to the passage of wavelike impulses of some sort over the surface of the sea, in response to which these creatures light up momentarily, after the manner of flashing fireflies.

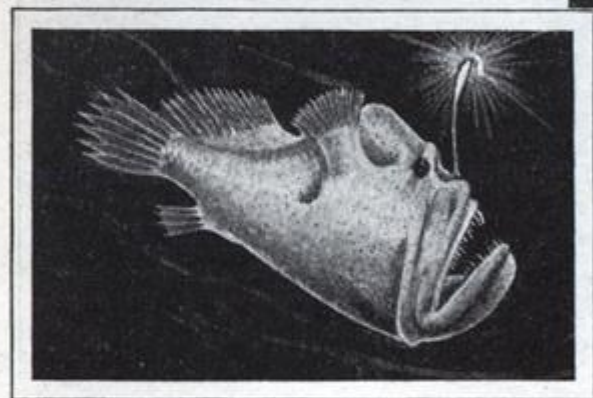
What these impulses might be is a profound mystery. Vibrations from submarine earthquakes or volcanic outbreaks have been suggested as a possible cause, but this suggestion leaves much to be explained.

There are several other mysterious luminous phenomena of the sea, and there is one on land that has been famous for ages, though it has received little attention from

Scientist Claims Will-o'-the-Wisp Is Caused by Luminous Bacteria



St. Elmo's fire on plants. Does this form of electrical discharge explain mysterious "flashing" of flowers by night? Scientists reproduce this phenomenon in the laboratory.



Here's a deep-sea fish that carries a lantern, the appendage on the snout being brightly luminous at the tip, as shown.

scientific men, especially in recent years. Here is a case reported in 1916 by Dr. Matthew Luckiesh.

The Mysterious Will-o'-the-Wisp

Dr. Luckiesh was tramping one dark night over the desert between Goodsprings, Nevada, and Ivanpah, California. About 2 a.m. he came to an area where a shower and melting mountain snows had left shallow pools of water. Suddenly a light was seen floating in the air about five feet above the ground. As its distance and size were unknown it might have been taken for a light in a cabin window but for the fact that there was no human habitation within twenty miles.

Presently the light sailed off some distance and then stopped. Soon others appeared; some floating apparently stationary, others darting here and there. When



The will-o'-the-wisp is the most eerie of luminescent phenomena. This drawing illustrates two types of this strange light as described by reputable witnesses. The type shown in the foreground is the most common.

the display was at its height hundreds of individual lights were visible simultaneously. The display was seen for more than an hour.

These lights were not fireflies, which are unknown in the region mentioned. Apparently they were will-o'-the-wisp, and they were so described by Dr. Luckiesh—but what is will-o'-the-wisp? Nobody knows.

Most reference books tell you that it is supposed to be due to the spontaneous combustion of gases escaping from decaying matter in the soil, and certain gases in particular are mentioned in this connection; but when tried in the laboratory they fail to produce the effects described. No chemist has yet manufactured a good imitation of will-o'-the-wisp.

Luminous Bacteria

Now it happens that many species of bacteria are luminescent; Dr. Molisch, the great German authority on luminescence, names twenty that shine by their own light, and he has utilized one species in constructing an ingenious "bacterial lamp," which gives enough light to read by.

Prof. Fernando Sanford has suggested that bubbles of gas rising from wet ground are sometimes laden with swarms of luminous bacteria, and that this is the true explanation of will-o'-the-wisp. His suggestion seems to be the best guess thus far offered on the subject.

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

25^c
JANUARY



Will We Beat The Russians
To The First Space Station
With This Passenger Rocket?

Special Section: AMERICA'S PL

How to Invent and Sell M

0502024 643 98 28 0656
S A BADANES
29 CLEARMEADOW DR
EAST MEADOW LI N Y

CE



ALL ABOARD FOR OUTER SPACE!

*Is this the ship that will take us
to earth's first manned satellite?*

**By G. Harry Stine, Viking-
Aerobee Operations Engineer,
White Sands Proving Grounds**

ON May 24, 1954, a Navy Viking rocket thundered 158 miles into space.

As recently as February 1949, a V-2/WAC-Corporal "Bumper" rocket soared 250 miles into the sky over New Mexico's White Sands Proving Grounds.

Just last year, an Air Force pilot flew the Bell X-1A rocket plane "above 80,000 feet" and at more than twice the speed of sound.

We have built rockets which have gone beyond the earth's atmosphere and returned; they have reached altitudes where the remnants of the atmosphere around them were a better vacuum than that in a radio tube. We have sent men to altitudes where their blood would boil if they were not protected by a pressure suit and a pressurized cabin.

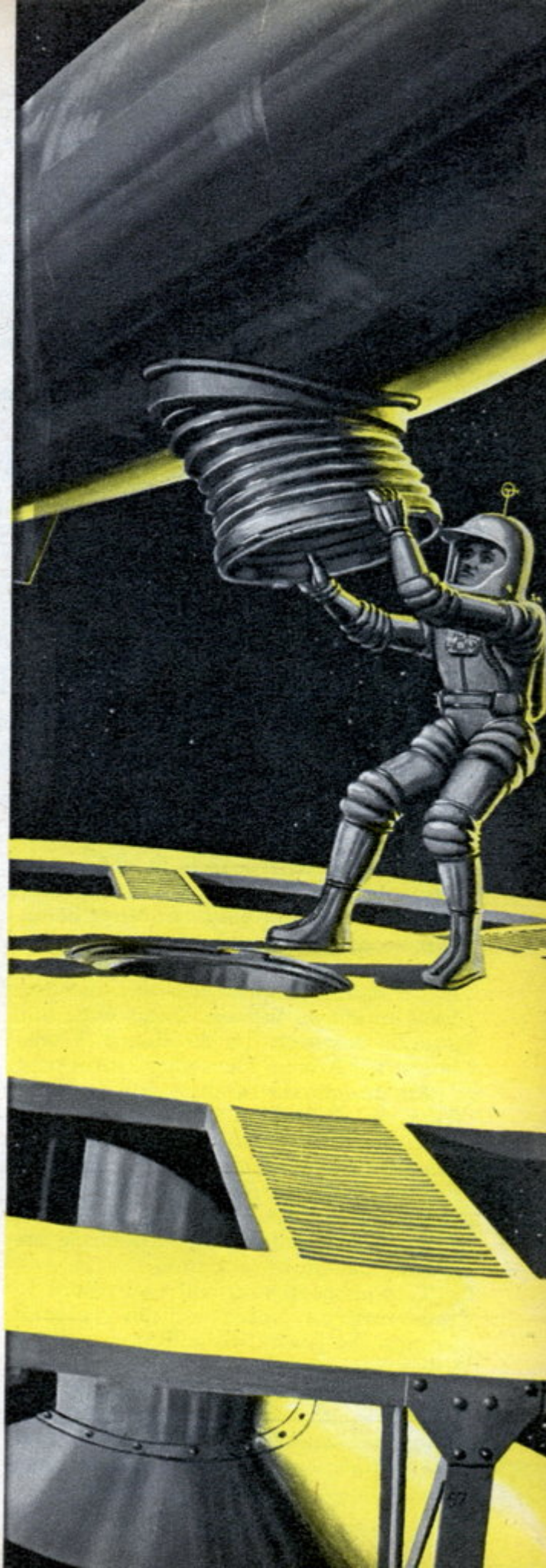
Soon we will go into space to stay. We have performed all the necessary theoretical work. We know how it will be done, and we can foresee some of the problems we will encounter. We are working with the prototypes of the devices which will finally overcome the greatest barrier of all: gravity. What remains now is only for the engineers and scientists to make the final steps . . . and they may already be making them.

The race for the artificial satellite and space flight is on!

In this greatest adventure of all history, America's pride and national prestige is at stake. There is no doubt in the minds of our rocket scientists and guided missile engineers that a satellite can be placed in space. They want America to do it first because, as free men, we want others to enjoy the freedom we have. We would use our satellite to prevent war; we would also use

◀ Huge three-stage rocket takes off, left. Illustrations by famed artist, Ken Fagg.

Space explorer about to enter air lock, right, in manned satellite circling earth.





First two manned boosters glide to earth as accelerating third takes crew to satellite.

it for peaceful research in chemistry, electronics, astronomy, physics, cosmic rays, biology, and a host of other fields. Our national reputation is such that we may even offer the services of the satellite research laboratories to other nations much as we are doing with our atomic research in President Eisenhower's "Atoms for Peace" program.

An unmanned satellite will be first. Then we will build Intercontinental Ballistic Missiles and may have to run extensive experiments with manned rocket planes such as the Bell X-1A, only bigger. But in the not too distant future a manned satellite will circle the earth in space.

To transport men and equipment to this manned space station orbiting around the Earth, we will have to have great towering ships powered by banks of rocket engines which gulp tons of fuel each second. Many rocket men—Dr. Werhner von Braun being the foremost—have conceived huge three-stage

rocket ships capable of making the flight to the space station. But recently a group of engineers from the Goodyear Aircraft Corporation told the American Rocket Society in New York how to do it easier, cheaper and more reliably. These three men—Darrell C. Romick, Richard E. Knight, and John M. Van Pelt—are working today on super-secret government rocket projects, but, as with many of their colleagues, they are very serious about the coming age of space flight. Darrell C. Romick, for example, is chairman of the American Rocket Society's 1955 Space Flight Symposium held at Chicago in November.

Their technical paper, entitled "A Preliminary Design Study of a Three Stage Satellite Ferry Rocket Vehicle with Piloted Recoverable Stages," presents a new approach to the old ideas and conceptions of space ships.

Rocket people have known for a long time that a rocket which could escape the Earth's gravity would have to be big.

Some engineers have calculated that over 99 per cent of its weight would have to be fuel—gallons and gallons of liquid oxygen and alcohol. But back in 1929 an Austrian scientist named Hermann Oberth developed the theory of the “step rocket.”

Essentially, this theory is simple. With a single-stage rocket such as the V-2 or Viking, the rocket engine must push the entire ship, including those fuel tanks which are already empty and therefore useless weight. The step rocket principle merely states that you must throw away what you no longer need once its usefulness is exhausted. This simple principle means that a ship will have to use less fuel to lift the same amount of payload away from the Earth; in fact, the step rocket principle makes space flight practical. And the principle has already been checked and proved with the two-stage V-2/WAC-Corporal “Bumper” rocket in which the WAC took off from the nose of the V-2 at high altitudes after the V-2 had exhausted its fuel. The V-2 alone was capable of reaching 132 miles; the WAC by itself could reach about 50 miles. Together,

they did not reach the sum of these, 182 miles, but the altitude of 250 miles!

But when these used portions of the space ship or step rocket—the lower stages or boosters—separate from the rest of the craft, they fall back to the ground again. The recovery of these big, complicated, and expensive boosters has always been a problem. Scientists have suggested that the launching sites be located on sea coasts to allow the boosters to fall into the ocean away from densely populated areas. Some schemes have been presented for recovering the boosters by parachutes.

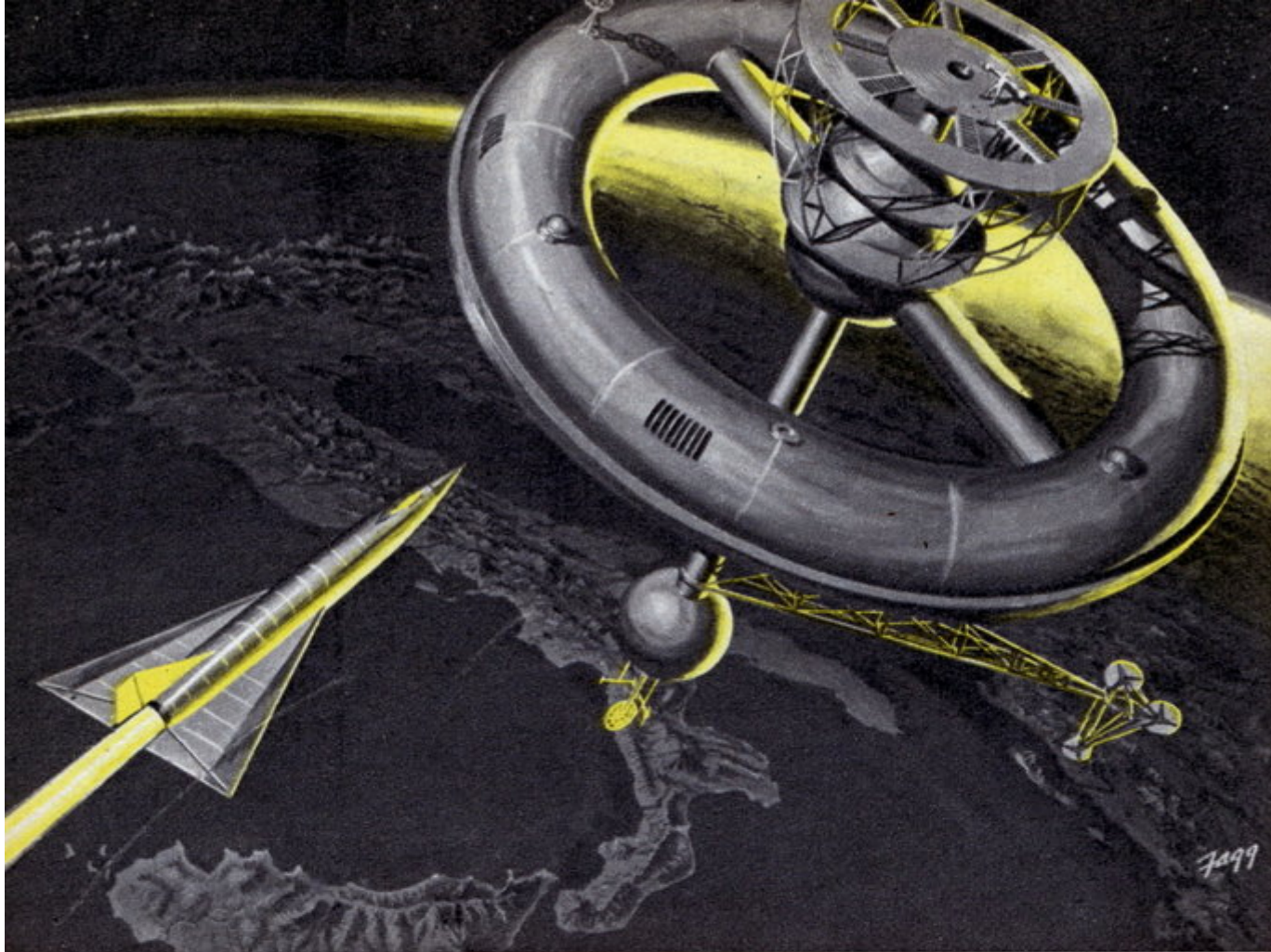
However, the three Goodyear engineers have designed a three-stage space ship whose boosters are manned with crews and flown back to the ground as gliders!

Roughly, their system would work like this:

The three stages of the space ship are assembled at White Sands Proving Grounds where final check-outs are performed and the ship readied on the launcher. Riding up on elevators inside tall loading towers, the three separate crews board the ship, one crew for each

Jet engines added to primary boosters enable them to be flown back to take-off site.





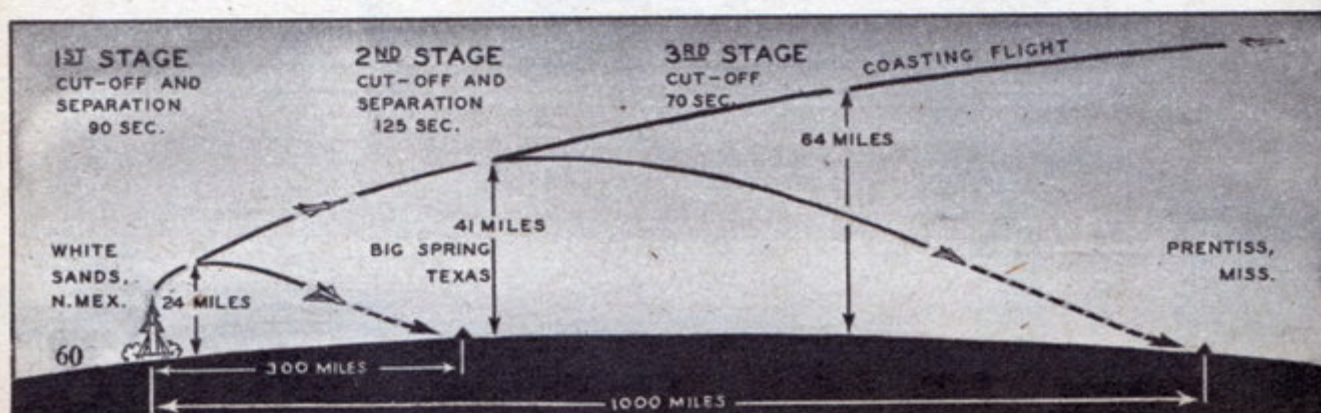
Reaching the satellite orbit, 1,075 miles above earth, final stage makes its landing.

stage. The 35 tons of cargo payload have already been placed aboard the top stage, which will be the only one to reach the space station. Final checks are made with the crews running pre-lift tests on each section of the ship.

At zero-time, the 9,000-ton ship will lift, driven by clusters of rocket engines in Booster 1, the lower stage, producing

16,000 tons of thrust. The crew in Booster 1 will be in complete control at this time, but if an emergency occurs the three stages can be separated, each to find its way to a safe landing under control. The ship tilts slowly to the east and, after 90 seconds, all the propellant in Booster 1 is used up. The first separation now occurs with the upper two

Diagram below illustrates how "step rocket" theory sends third-stage ship into space.



stages being ejected forward. The big clam-shell doors in the nose of Booster 1 close and it prepares to re-enter the atmosphere and glide to a landing. Somewhere in the vicinity of Big Spring, Texas, it will be low enough for the pilot to put down the landing gear and bring the huge booster to the ground at a landing speed of 175 mph, much like an ordinary airplane.

The upper two stages continue their flight without Booster 1, and after 125 seconds Booster 2 runs out of fuel and separates, leaving the upper stage on its own. The nose doors on Booster 2 close and it makes a landing somewhere to the north of Prentiss, Miss.

The final stage keeps on accelerating for another 70 seconds, then coasts upward to its rendezvous with the space station 1,075 miles above the surface. When it reaches the satellite orbit, it makes a final maneuver of four seconds' duration, and the trip is complete.

But on the ground there is much activity at Big Spring, Texas, and Prentiss, Miss. Jet engine pods are being slung under the delta wings of the two

boosters to convert them into large jet airplanes. This will probably take only a day or two and is a simple procedure. Jet engines are removed and new ones installed on jet bombers today in a matter of hours.

Then the crews fly the boosters back to White Sands. Take-off is made with the full power of the jets—16 of them on Booster 1 and 8 of them on Booster 2—plus about 10 per cent of the rocket motors. Once in the air, the rocket engines are shut off and are used only for emergencies; the boosters fly on like normal airplanes under the thrusts of their turbo-jet engines.

After both boosters have landed back at White Sands on long runways, the engine pods are removed and shipped by rail, truck, or air back to Big Spring or Prentiss. The big boosters are then given a careful and complete check and overhaul; any needed repairs or modifications are made. Then they are made ready for assembly into the complete space ship again.

The final stage of the ship makes its return from [Continued on page 198]

Rocket engines power ship's return flight until it hits earth's atmosphere, glides down.





MISSILE VS. MISSILE

**A rocket expert looks at our chances
of withstanding a missile invasion.**

BY WILLY LEY

SOMEbody said recently that he would not be surprised if the AAF were re-searching itself out of business, at least as far as flying personnel is concerned. This somewhat surprising statement was based on the fact that a good number of the research projects which have been made known are aimed at high-velocity flight, either true supersonic flight or something close to it. Most of this fast flying would necessarily take place at very high altitudes where there is not too much air to interfere. And since the ramjet, the rocket





and the rocket airplane can be improved more than the pilot, the pilotless missile is bound to be the final result in many cases.

That there are important advantages on the side of the pilotless missile, especially the long-range missile, has been recognized for quite some time. Soon after the end of the war in Europe my friend A. V. Cleaver of de Havilland Aircraft (England) pointed out that V-2 rockets might be actually cheaper than bombers as far as

the delivery of high-explosive is concerned.

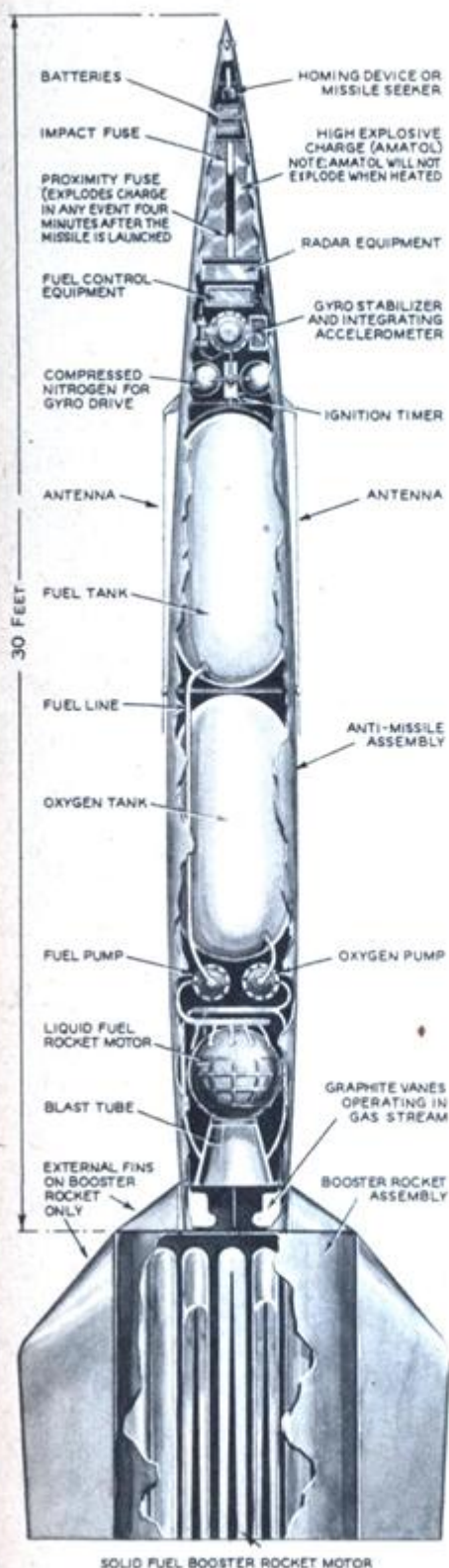
It is true that a V-2 burns up a little over eight tons of alcohol and expensive liquid oxygen in order to carry a one-ton bomb over a distance of 200 miles. It is also true that a large bomber can carry about eight times the bomb load of a V-2; but it costs over 30 times as much. It also needs a crew whose training is a big item in the budget. It needs hangars and airports with long runways.

In order to compete with V-2 rockets, as regards poundage of bombs delivered per dollar of expenditure, a bomber would

Left: This radio-controlled, jet-driven target plays the role of an attacking missile for A-A gunners.

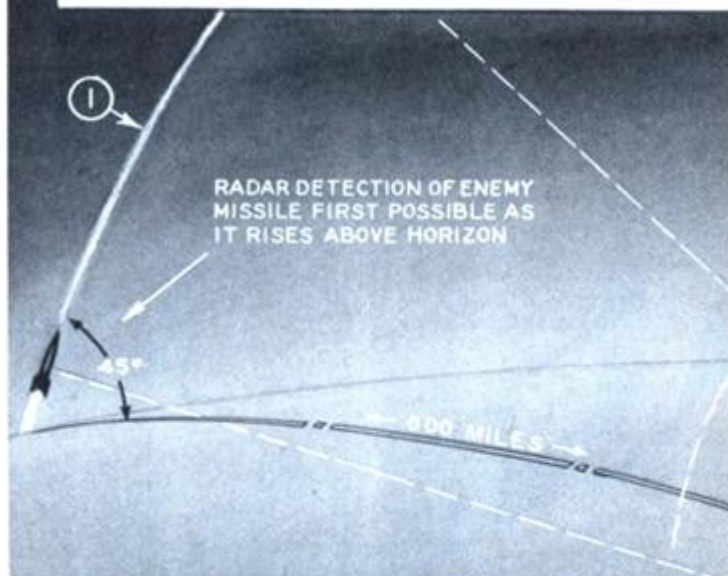
September, 1947

Liquid fuel motor takes over after booster drops off at 10-mile altitude. Ground station activates homing device which seeks attacking missile. Right: Long range attack and defense.



MISSILE vs. MISSILE - TRAJECTORY KEY

- ① INITIAL TRAJECTORY OF ONCOMING ENEMY MISSILE.
- Ⓐ AREA MOST VULNERABLE TO DEFENSE INTERCEPTING ROCKETS, WHERE ENEMY MISSILE IS SLOWEST.
- ② THEORETICAL IMPACT-TRAJECTORY OF E. MISSILE.
- ③ ACTUAL IMPACT-TRAJECTORY OF E. MISSILE FROM 120,000 FEET DOWN DUE TO AIR RESISTANCE.
- ④ PRIMARY INTERCEPTION FROM ADVANCED BASES.
- ⑤ SECONDARY (LAST RESORT) INTERCEPTION FROM BASES LOCATED IN THE ACTUAL TARGET AREA.

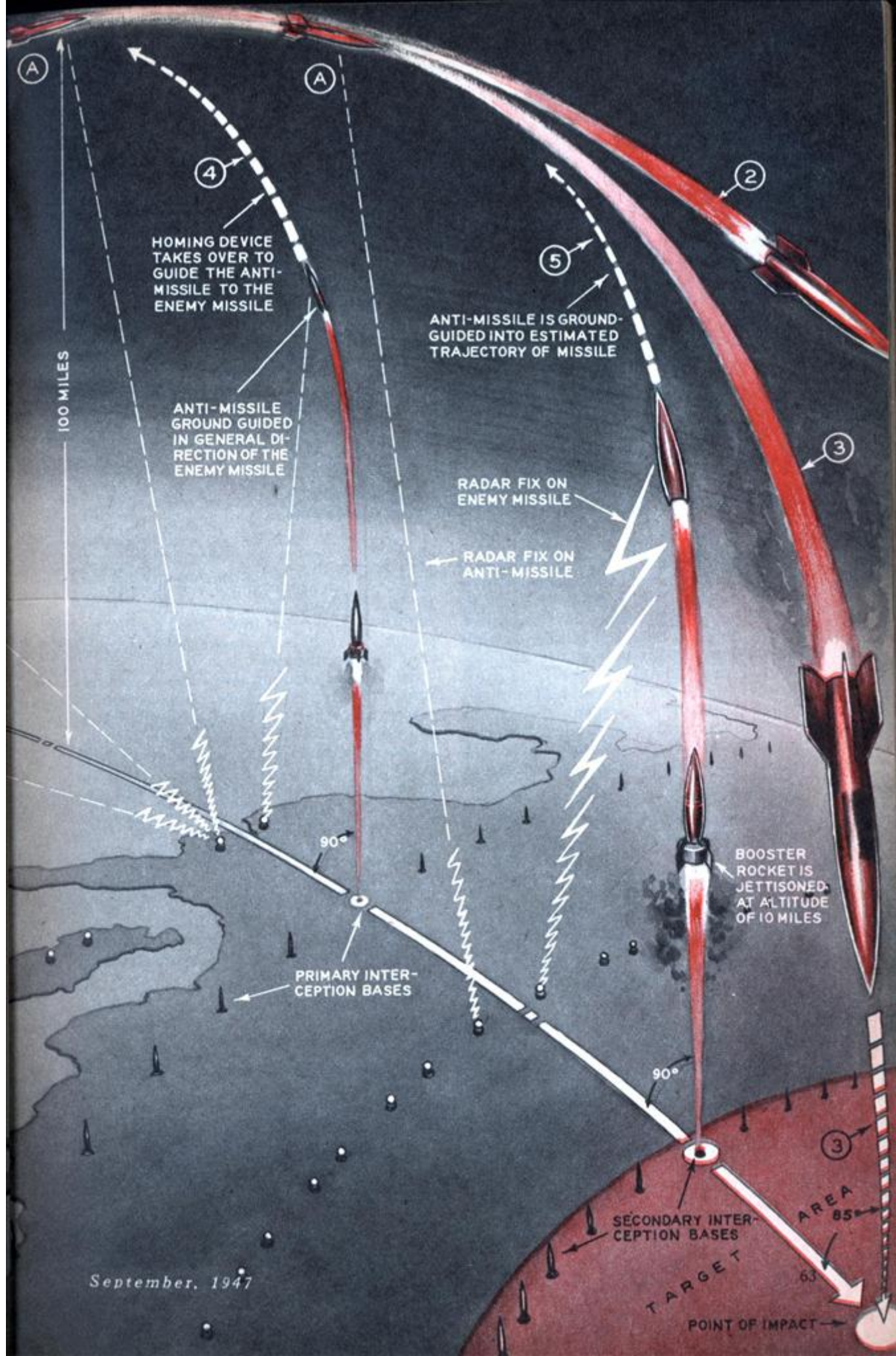


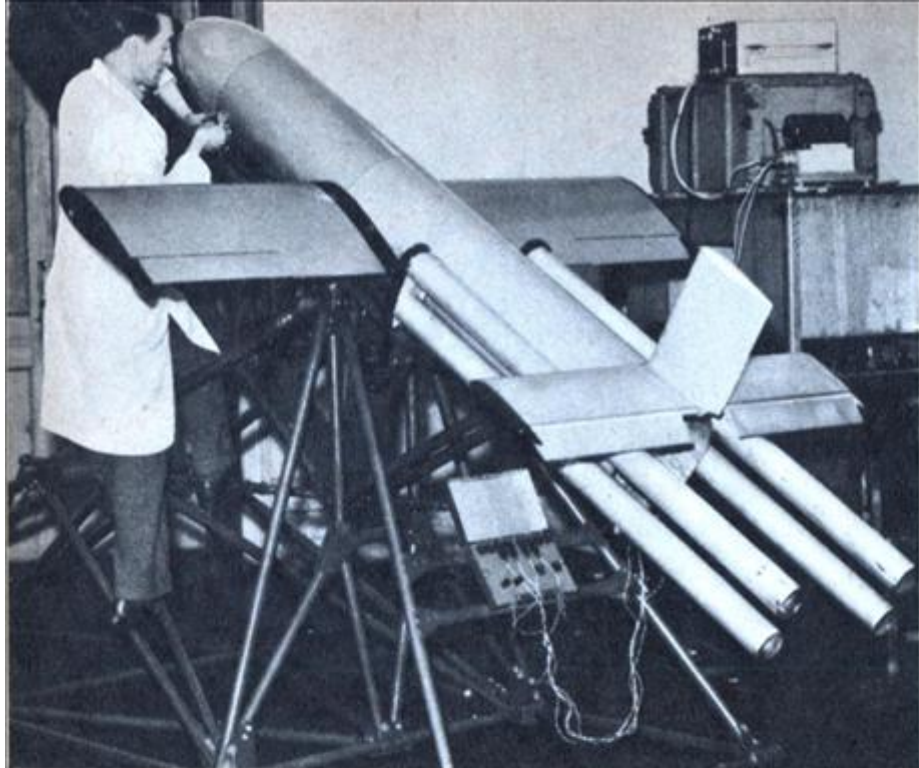
have to fly about a hundred missions before retirement. We all know that bombers, as a rule, did not fly a hundred missions. And bombers can still be grounded by bad weather, long-range rockets are not. Bombers could be intercepted by fighters or from the ground, long-range rockets could not. The only real advantage of the bomber during the last year of the last war, was higher bombing accuracy and longer range.

With atomic bombs accuracy is no longer important.

"And the range of long-range rockets can be increased. It may be a tough job to do so, but it can be done. The only open question is whether long range rockets will stay non-interceptible for all time to come. When the V-2 rockets were used, interception was impossible and it would be interesting to learn whether it was tried at all. Londoners saw falling V-2's on occasion, and it is conceivable that an anti-aircraft gunner fired a shot or two. If so, and if he did score a hit, it would probably just have meant that the warhead of the V-2 rocket crashed into the city a few hundred yards away from the point where it would have crashed otherwise.

Could specially designed anti-aircraft artillery, or anti-aircraft missiles do better? Let's see how much space, or rather how much time they would have to work in.





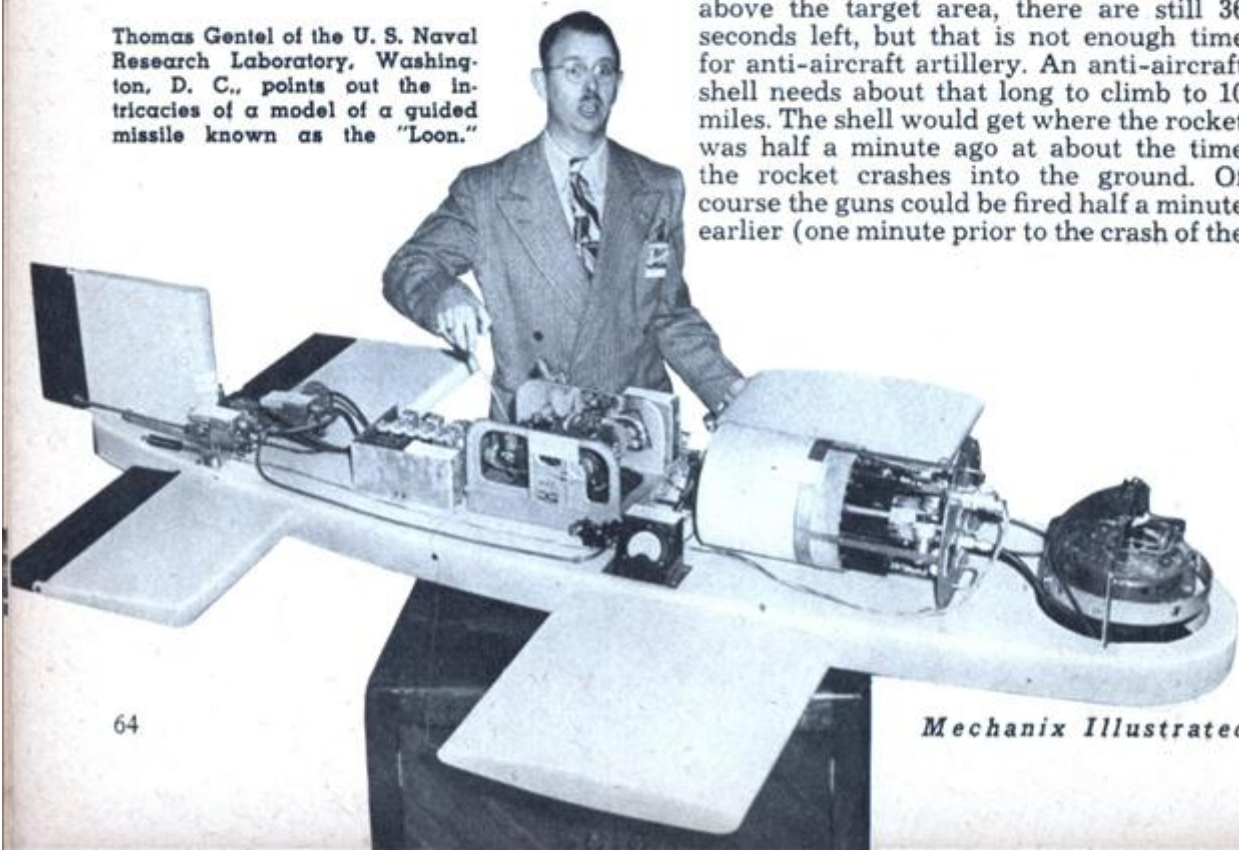
Left: The "Stooge," first pilotless radio-controlled rocket missile developed in Britain. It has range of eight miles, speed of more than 500 mph. Fired from ground base, it can be maneuvered accurately to target. It is considered a weapon of defense—possibly, with future developments, against bombers carrying atom bombs.

A V-2 rocket—to stick to something that is known and in actual existence—travels along a trajectory which looks like, and is, the chopped off upper section of an ellipse. The two points where the ellipse touches the ground are 200 miles apart, the distance measured along the ellipse is a little short of 300 miles, and the highest point midway between take-off and crash is 70 miles above the ground. The highest velocity along that trajectory is almost precisely one mile per second, but when the rocket

returns to the ground, entering denser layers of the atmosphere, it is greatly retarded, striking with "only" about 1,000 mph or a little less than $\frac{1}{3}$ of a mile per second. The whole trip makes a few seconds short of five minutes.

Since radar cannot "see" over the horizon, no present or future radar set could catch the rocket at actual take-off, but it can do so when it rises above the horizon. If the defense is lucky, their radars will give them some four minutes' warning before impact. When the rocket is 12 miles above the target area, there are still 36 seconds left, but that is not enough time for anti-aircraft artillery. An anti-aircraft shell needs about that long to climb to 10 miles. The shell would get where the rocket was half a minute ago at about the time the rocket crashes into the ground. Of course the guns could be fired half a minute earlier (one minute prior to the crash of the

Thomas Gentel of the U. S. Naval Research Laboratory, Washington, D. C., points out the intricacies of a model of a guided missile known as the "Loon."



rocket) at the point where the rocket will be 30 seconds later. But it is obvious that it would need a large and probably practically unfeasible expenditure of anti-aircraft shells to hit a falling rocket. And if a rocket carries an atomic warhead the explosion of that atomic charge a few miles above a city is nothing pleasant to contemplate.

Obviously, interception should take place much earlier than 30 seconds before crashing, and especially at a time when the rocket is not almost vertically over the target area but a large number of miles away horizontally, so that the explosion of the presumed atomic warhead takes place *very high* and at considerable distance from the target area.

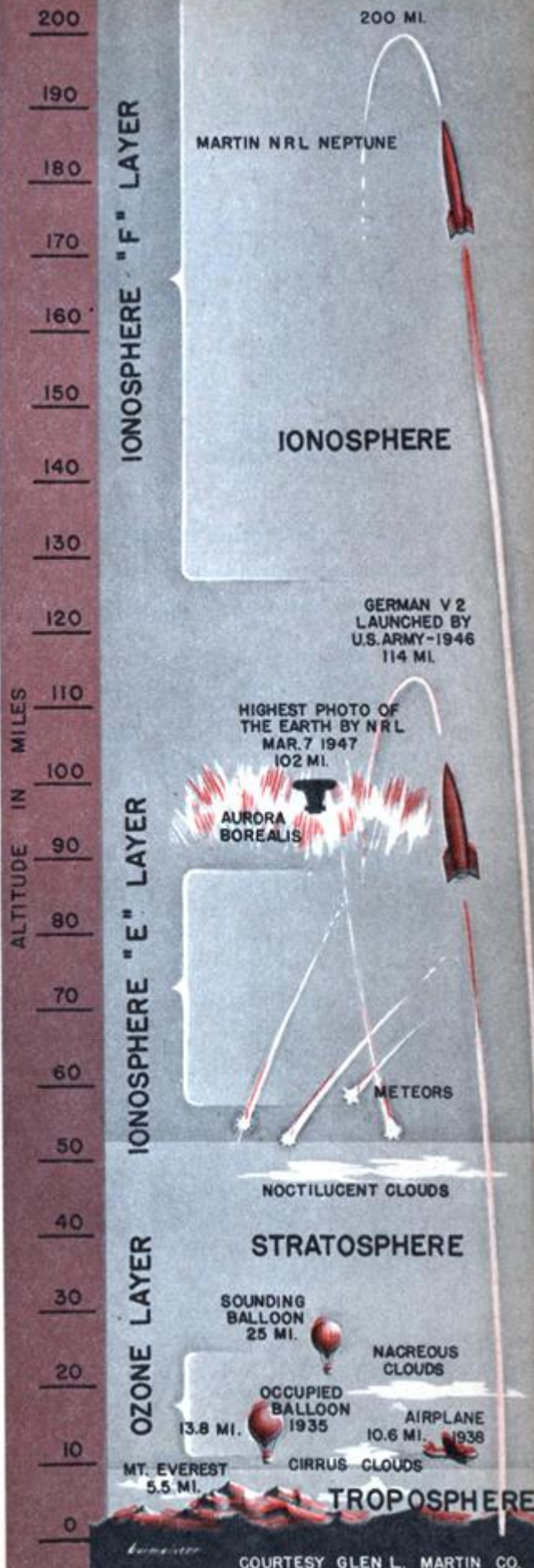
Anti-aircraft guns don't have the necessary long reach to do that, but rockets have. The only possibility for intercepting a long range rocket is another long range rocket. A rocket held in readiness and fired at the instant where the radars catch the enemy rocket rising above the horizon, will theoretically intercept the enemy rocket reasonably near the halfway mark. It would be almost a hundred miles away and some 50 miles up, virtually in empty space where even an atomic explosion would not do any damage.

Naturally you could not intercept a long-range rocket at such a distance simply by aiming at it. The intercepting rocket would need special devices and the weight of these special devices would probably cause the intercepting rocket to be as large as the attacking rocket. Guiding the intercepting rocket by means of radar leaps to mind as a possibility, but to be reasonably accurate, even with a proximity fuze and with a defensive atomic warhead, would require several ground radar sets, spaced far apart.

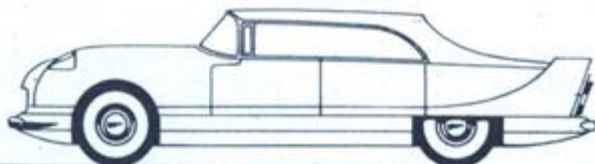
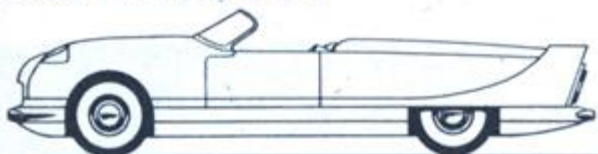
It sounds more likely to equip the intercepting rocket with a homing device. We can assume that the attacking rocket is hot. The skin of the attacking rocket must have heated up on its upward path even if not as much as it will heat up on the downward path. The ascending rocket is slowest where the air is densest near the ground, while the descending rocket is fast in the dense air. And the rocket motor, even if cooled, must still be radiating some heat a few minutes after burning. This should be enough for a sensitive heat device. And it is hard to see [Continued on page 170]

Right: Drawing shows heights various objects have reached above earth's surface. Atomic missiles could—theoretically—be intercepted safely 50 miles up and 100 miles away horizontally.

September, 1947



COVER STORY



Changing bodies makes one chassis into a variety of cars designed to fit

MI's All-Aluminum MULTICAR

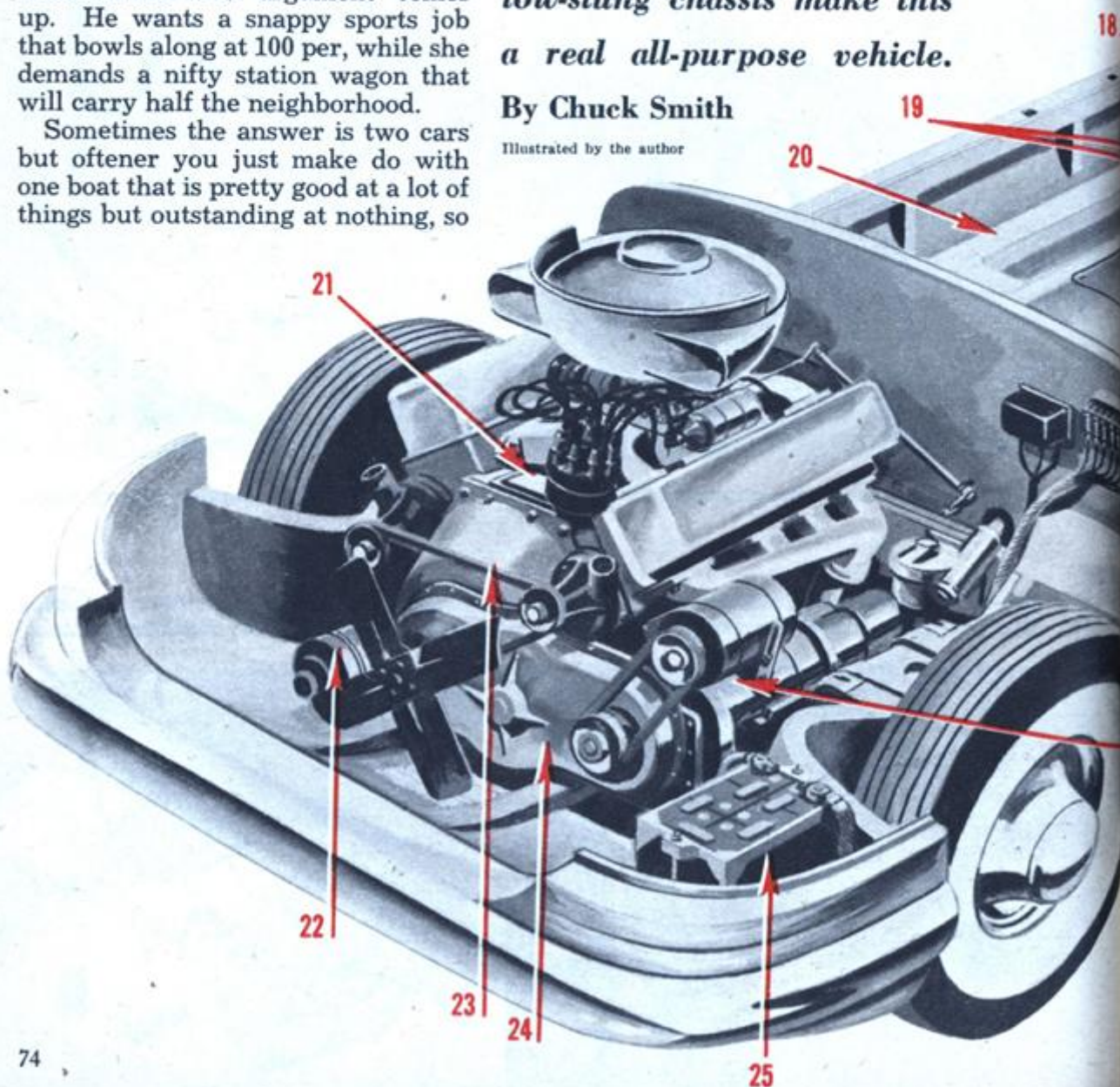
ALMOST every time a family goes out to buy a new car the same husband-and-wife argument comes up. He wants a snappy sports job that bowls along at 100 per, while she demands a nifty station wagon that will carry half the neighborhood.

Sometimes the answer is two cars but oftener you just make do with one boat that is pretty good at a lot of things but outstanding at nothing, so

Interchangeable bodies on a low-slung chassis make this a real all-purpose vehicle.

By Chuck Smith

Illustrated by the author





any need; styles are sport coupe, hardtop sedan, station wagon and pickup.

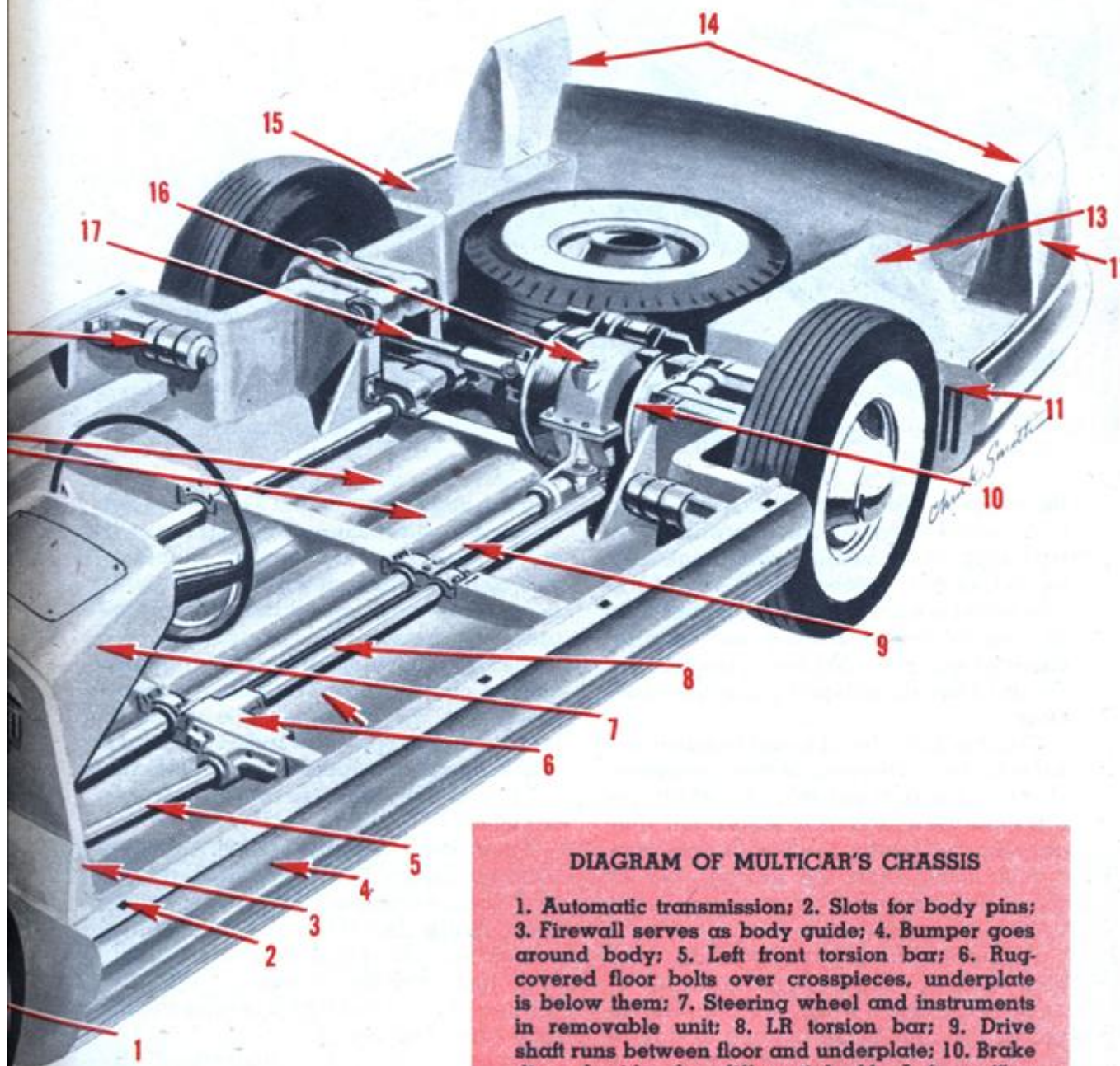
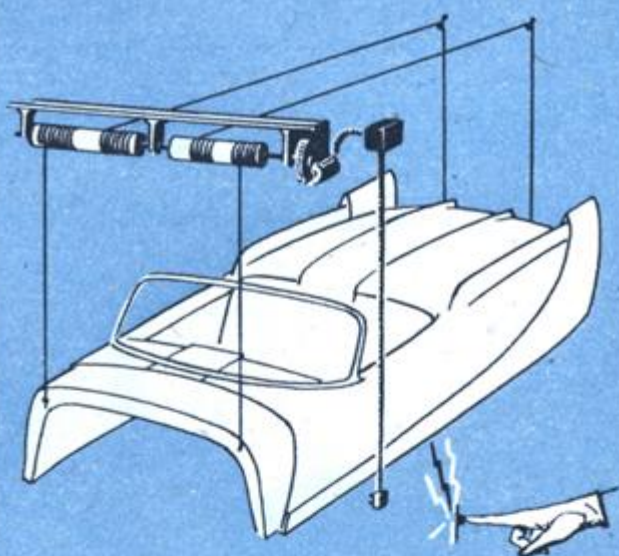
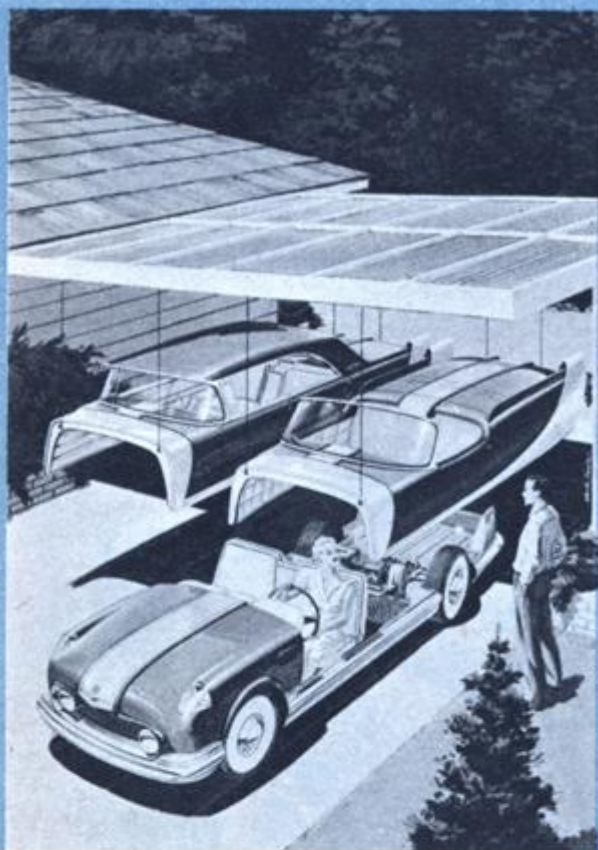


DIAGRAM OF MULTICAR'S CHASSIS

1. Automatic transmission; 2. Slots for body pins; 3. Firewall serves as body guide; 4. Bumper goes around body; 5. Left front torsion bar; 6. Rug-covered floor bolts over crosspieces, underplate is below them; 7. Steering wheel and instruments in removable unit; 8. LR torsion bar; 9. Drive shaft runs between floor and underplate; 10. Brake discs beside the differential; 11. Left muffler; 12. Gas filler in the taillight housing; 13. Gas tank; 14. Taillight housings help position the body; 15. Right muffler; 16 and 17. Differential mounted solid, drive axles are full floating; 18. Motor assembly for locking body pins; 19. Alleys for twin exhausts; 20. Sill for mounting floor; 21. Motor is offside beside gear box; 22. Starter; 23. Torque converter; 24. Transfer case; 25. Battery.



Remote-control overhead lifts in garage change Multicar bodies in as little as five minutes. First body is lifted off and chassis is moved under desired unit.

three years ago I got an idea for a car that would solve all such problems, a true all-purpose vehicle which not only looks like but is several different cars. The secret is interchangeable bodies that fit one universal chassis and can be changed quickly. MI now presents the result of my design project as the Multicar.

This car has a lot of novel features besides its four different bodies, however. It is made almost entirely of cast aluminum, the weight is only about half that of a standard auto, the design makes it a foot lower than the average car of today and the price of mass-produced units is in line with other autos.

A Multicar family is set for any kind of driving. We'll say it's Saturday afternoon. The kids are at the movies, so young Joe and Mabel Brown decide to go for a spin in the country. The car is now a station wagon because last night they took a bunch of friends to a football game.

While Mabel waits in the driveway Joe backs into the garage, throws three switches on the dash and tips the hood forward. He attaches four thin cables

and the body is lifted off. Then he backs under the sport coupe body, lowers it and makes sure it's locked in place. The couple ride off down the street with the top down. Elapsed time: five minutes.

Sunday morning the whole family goes to church in the dignified hardtop sedan. In the afternoon Joe wants to haul some fireplace wood so another quick change produces a rugged pickup.

Thus is the Multicar an all-purpose vehicle.

I have designed four bodies, although most buyers probably would want only two. Likely combinations would be the sport coupe for trips and the station wagon for shopping, carrying friends and just general hauling. For the farmer, the sedan-pickup combo should take care of all needs.

As indicated in the illustrations, the detachable bodies extend from the tail-light housings to the firewall. The front seat is attached to the chassis, while the windshield, rear seat and other upper parts are on the body. Let's consider the bodies:

Sport coupe: Carries three pas-

sengers; roof folds into rear deck; huge trunk.

Hardtop sedan: Carries six; four doors; large trunk.

Station wagon: Carries eight, three in front, three in middle seat and two in twin seat facing aft. The back half of the roof slides forward to make a rumble-seat-in-reverse out of the wagon's rear. Rear seats lift out and center seat folds forward and locks to back of front seat to make a long, open rear deck.

Pickup: Cab seats three, is closed and has a rear window. Bed is seven feet long and 18 inches off the ground.

The bodies are stored in a regular height garage, slung from the ceiling on cables. Raising and lowering is done by an electric motor with shaft and pulleys, controlled by a button at hand height or an electronic dash control.

To reduce man-hours in assembly, the chassis is divided into three large castings, which contain all bearing seats. The sections break at the firewall and just behind the differential. After casting, parts such as wheels, motor and running gear are simply attached to the chassis—like putting together a model airplane at home.

Any standard V8 engine will fit the Multicar but an even better power plant is one of the new aluminum jobs envisioned recently by several companies, including Alcoa. Aluminum content

runs as high as 70 per cent and weight is reduced accordingly.

One of the Multicar's big changes is the power transmission setup. The engine is moved offside and sitting beside it is the automatic transmission. The torque converter goes in front of the engine, all of which means a level floor without humps.

The chassis is solid underneath, covered with an underplate that makes it as strong and rigid as a bathtub. It is only seven inches from the ground. On top of it go frame members that are three inches high. To them is bolted the rug-covered floor, which is ten inches off the ground. In the three-inch space between floor and underplate run the driveshaft, torsion bar springs and alleys for the twin exhausts.

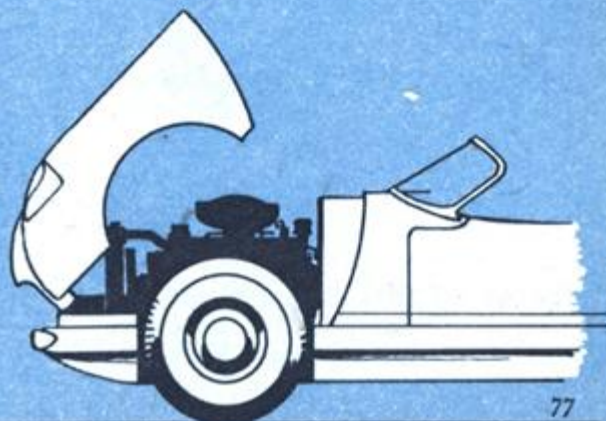
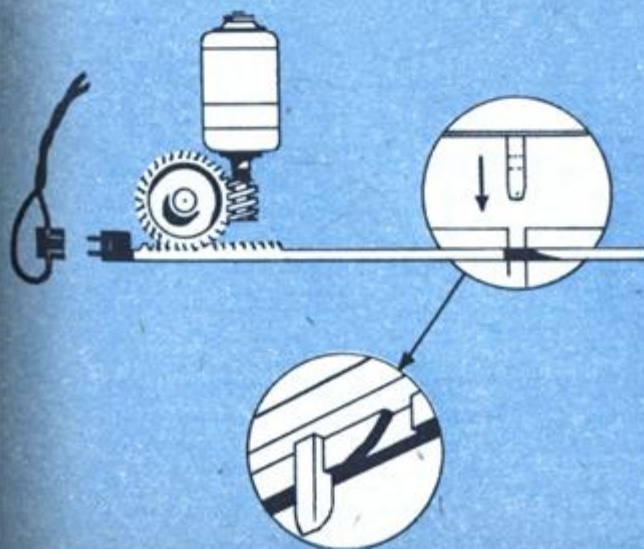
In this car the differential is bolted solidly to the frame, while both short drive axles are free-floating and carry brake discs near the differential.

The Multicar's wheelbase is 120 inches, overall length 206 inches. With 8x14 tires the hood is an amazing 42 inches high, with the roof less than 54 inches. Inside room is greater than that of most standard cars on the road today. A low center of gravity makes it impossible to overturn.

A variety of colors could be used on the aluminum body, with the pigment anodized in the metal at casting time. •

Detail drawings show how a motor and bar pull sloped tongue through slot in a pin to lock body to chassis. Device at left cuts ignition except when body is secure.

Hood of the Multicar tilts forward for the maximum servicing room and when bodies are being changed. Note low silhouette. Floor is only 10 in. high and clearance is 7 in.



MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

25^c
JANUARY

ALL-ALUMINUM CAR COMES
WITH CHOICE OF BODIES!

See Page 74



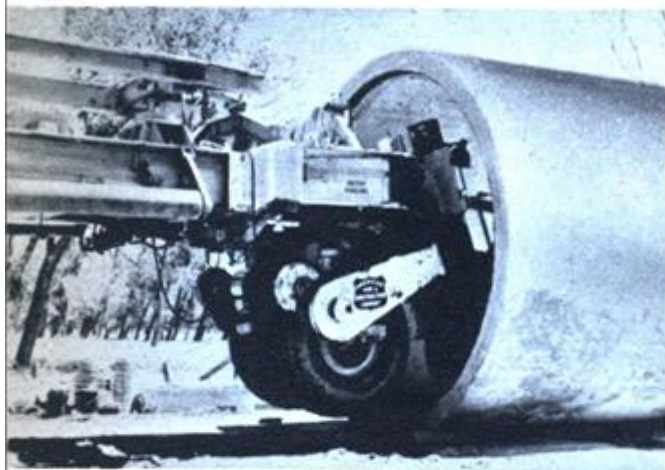
ONE-MAN SUBMARINE FOR UND

MAIL VIA ROCKET • YOU'LL OV

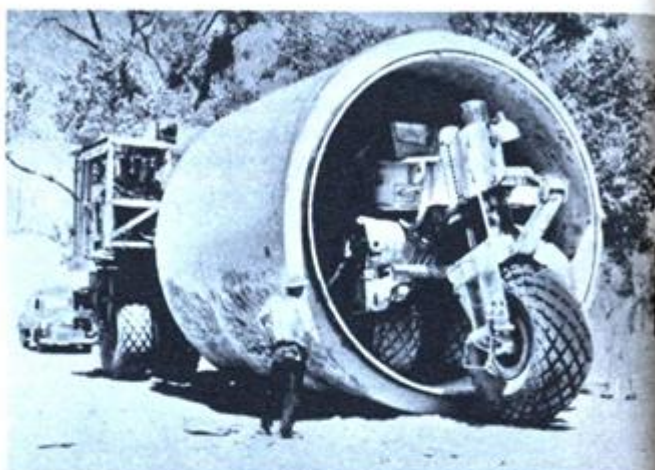
510226 181 19 24 1158
RALPH L. BARNES
RD 2
DUNCAN, IOWA

THE Pipemobile moves pipes—really big pipes—like the 67-ton, 13-foot diameter jobs on these pages. The American Pipe and Construction Co. of

South Gate, Calif., devised this \$200,000, one-of-a-kind machine. When the Pipemobile is ready to go to work, its large front wheel "steps up" into the pipe.

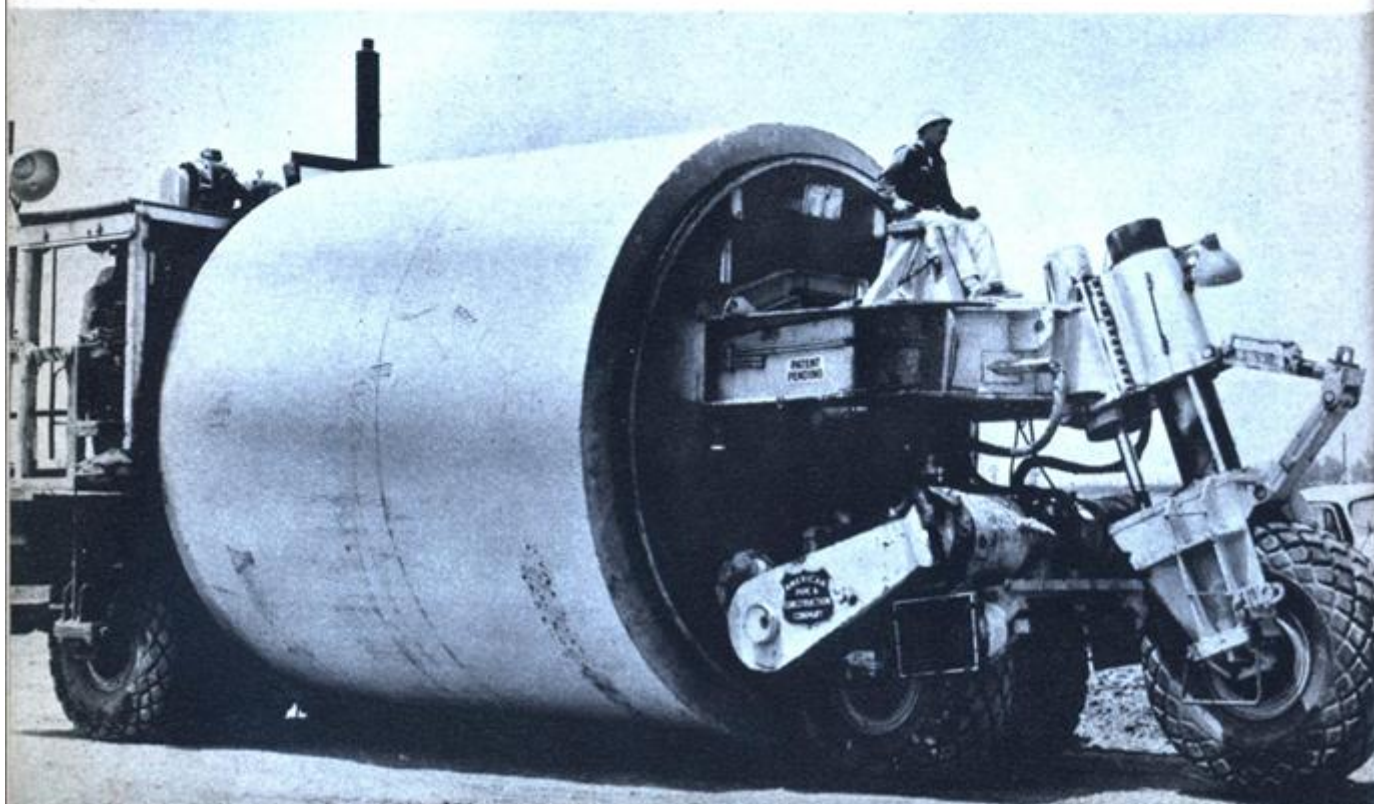


FRONT WHEEL has "stepped up" into pipe, supports rig and raised wheels behind it.



EMERGING at other end, front wheel "steps down." Now Pipemobile is almost through.

READY TO ROLL. The Pipemobile has now made this 67-ton, 13-foot pipe section mobile.



"PIPEMOBILE"

This wheel then supports the rig from inside the pipe while the two wheels behind are raised for entry. At the other end of the pipe, the wheels "step down"

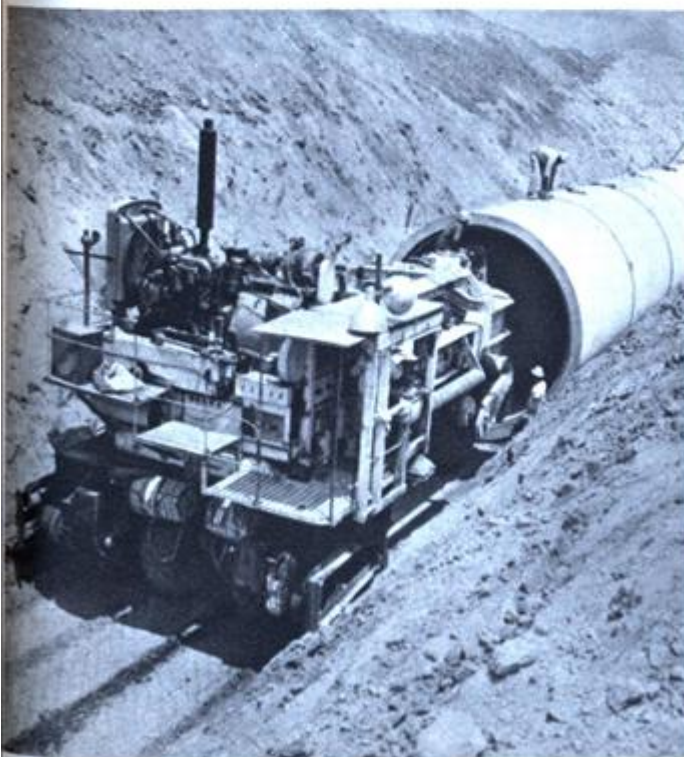
to the ground and the Pipemobile is ready to raise the pipe, move it and join it to other sections. Now if you have a big pipe . . . •



PIPEMOBILE takes the section from storage area to the pipeline site to be connected.



BIG INCHER skillfully eases one pipe next to another, securely fastens two sections.



BACKING OUT to get another section. Mammoth machine saves time, labor and money.



PIPELINE of over 2,500 sections will bring Colorado River water to San Diego County.

PREVIEW OF THE 1961 CARS!

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

What Is This \$200,000
Machine Doing?—See Page 68

Best Buy
25¢
JULY



Tips From
An Expert

SKIN-DIVING FOR BEGINNERS

BIG CONTEST! SPORTS CARS, \$20,000 IN FREE PRIZES!

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

25^c

JULY



RAILROADS IN THE SKY

**Complete Story of Monorails,
Exciting Trains of Tomorrow**

HAVE YOU LIVED BEFORE?

**...Will You Live Again?
Truth About Reincarnation**

FREE VACATION

**U. S.
No Cost**

0956

0509032
H J DICK
BOX 46
EARLY 10WA

RAILROADS IN THE SKY

MI
special
features

*Monorails promise swift and
economical transportation
for congested cities.*

By Archie Robertson



CONTINUED . . .



The Fiberglas coaches of the Houston monorail are invitingly light and comfortable.

HERE'S a brand-new way of travel for American commuters—the overhead, suspended train. In a monorail coach, light and roomy as a luxurious airliner and faster than a surface train, you will skim along above the crowded downtown streets, looking with thankfulness at your escape from a misery of crawling cars, traffic fumes, honking horns, whistling cops and squealing brakes. Whether you're just going downtown to shop or commuting to work 50 miles from your home, a monorail will take you where you're going two or three times as fast as conventional surface transportation.

The Houston, Texas pilot monorail that opened for demonstration purposes last winter is only 970 feet long, and passengers are allowed to ride free. But in other respects, it is very much like the full-length lines which its backers plan to build soon.

The single "rail" of the Skyway, as the Houston line is called, is a 30-inch pipe

supported by 30-foot towers set at 50-foot intervals. At one end of the present line the passengers ascend to a loading platform; at the other the rail declines to bring the coach to ground level. The passenger car hangs below the rail; above it ride the two 305-hp engines, the control equipment and driver's seat. The unit rides on eight pneumatic-tired wheels; 16 rubber guide wheels keep it in place on the rail. People who have taken the free trip report a nearly silent ride with little sense of motion. The coach has a Fiberglas body and large plexiglass windows; the effect inside is light, airy and cheerful. Seats along the sides accommodate 60 passengers and 50 more can stand comfortably.

The reasons for the monorail can be summed up briefly. Six million new cars coming along every year add to downtown traffic congestion which already causes an economic loss estimated in the billions. Conventional elevated

roads and railroads block light and air from the streets below. Subways and surface railroads lose money. And aircraft aren't yet ready for the job of carrying the public to work and back.

In several major population centers monorails are much closer to construction than the general public realizes. Their safety and dependability have already been proved in steel mills and other industrial plants, and full-scale plans for passenger-carrying monorails have been drawn for Los Angeles, San Francisco, Montreal, and Washington, D. C. The plan for Los Angeles awaits action by the California legislature, to enable the operating company to issue revenue bonds. It includes a 44-mile line between Fernando and downtown Los Angeles, with ten-car trains having a top speed of 100 mph. Even with 15 stops in this distance, the trains will maintain an average speed of 41 mph. This will make it by far the world's fastest transit system. (New York subway expresses average only 24 mph.)

The Los Angeles monorail system, designed by Gibbs & Hill, a New York engineering firm, will have automatic train control. Trains will berth themselves correctly at each station. Doors will open and close by themselves. The train attendant will ride up front in a plexiglass bubble to watch for possible obstructions, like a tall crane passing below. In this case, of course, he'll be able to stop the train. Escalators will carry passengers up and down from the street.

One monorail plan eliminates bus-to-train transfers for off-line passengers. You'll be able to board a bus at your usual corner to start your trip downtown. When the bus reaches its monorail station a steel frame will be lowered from the overhead rail. The bus will drive into it, the frame will lock around it and hoist it up. Without leaving your seat in the bus, you'll be whisked over congested downtown areas to your destination.

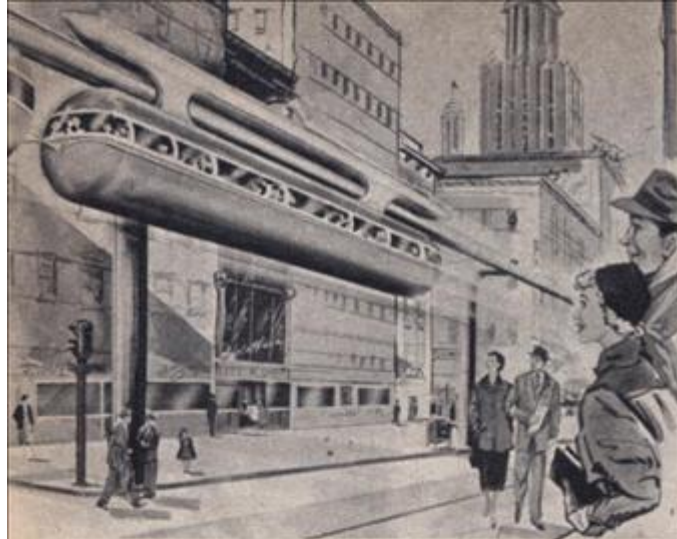
The monorail is highly adaptable. In the Los Angeles plan, for example, it takes a dive underground to operate for two miles as a subway. Out in the country, its single row of pillars can be erected in the grassy, center strip which

divides modern, separated expressways and thruways. Edward H. Anson, the vice president of Gibbs & Hill, has sketched a plan for a double loop monorail around the heart of Manhattan, with several cross-town lines to relieve congestion on the East-West streets. At rush hours, these are probably the scene of the nation's worst traffic snarls with a staggering loss in time and money as a consequence.

Monorail enthusiasts, of course, do not claim that theirs is the only answer to the traffic problem. More thruways and expressways are needed, all engineers agree. But expressways and thruways fill up with new traffic jams almost as fast as they are built. The New Jersey Turnpike is now carrying the volume of traffic which it was expected to carry some 30 years hence. Also, deluxe new highways always bring more cars into town every day, to be parked—somewhere. And they cost a lot to build, not only because of their massive construction but because expensive property must be condemned to secure the right-of-way for a city freeway. To build one mile of modern automobile freeway costs from \$4,000,000 to \$6,000,000; a monorail line of the same length costs

Monorail in Wuppertal, Germany, has run since 1902 without a passenger fatality.





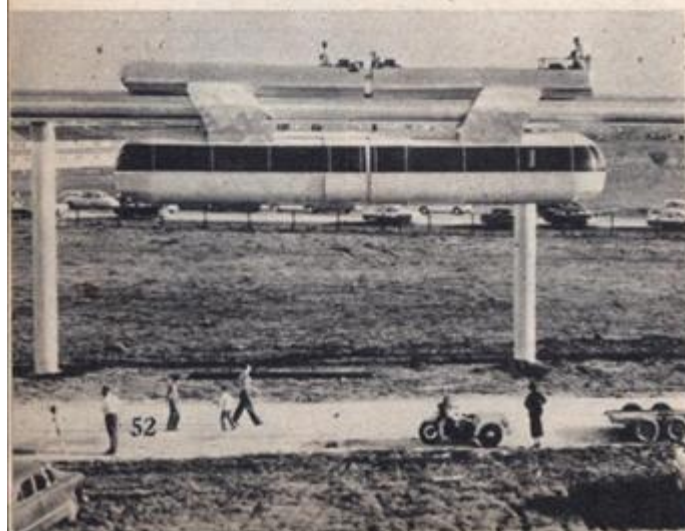
Monorail advocates predict quiet, sunny streets when mass transport goes upstairs.

only \$500,000 to construct.

When it comes to the number of people who can ride, the comparison is even more staggering. The monorail train—allowing for ten cars—can easily move about 24,000 passengers per hour, running on a 90-second headway between trains as in the Los Angeles design. Compare that with the mere 6,000-7,000 people who can travel a six-lane highway in private automobile during the same time—if we allow for the national average of about 1½ passengers per car.

It doesn't look as if we're going to build many more miles of subway systems or suburban surface lines. Virtually no subways have been constructed since 1940. They cost about four times as much to build as monorails and they lose money, steadily. The

Short demonstration line in Houston, Texas, is selling the public on riding the monorail.



New York subway system, the world's greatest, runs deeper into the red every year as its passenger traffic declines while its fares go up. In general, the same sad story is true of commuters' trains around New York, Chicago, Philadelphia and other large cities. Almost without exception their managements report that the trains are run at a loss, schedules are being curtailed or service being abandoned altogether.

Highspeed buses, or trains of buses, running on elevated tracks above the city streets have also been suggested. But an elevated roadway, of any kind, has the serious disadvantage of cutting off the light and air from the street beneath it.

Monorails of the present are not remotely like the old elevated railroads. On the Houston line, for example, the pillars are spaced 75 feet apart in a single row. The light, airy structure deprives nobody of sunshine and fresh air. There's plenty of room for flowers and trees and no occasion for traffic accidents on the surfaces. Operations are quiet—no rumble, roar or clicking ties.

The monorail train isn't a new invention. It was proposed in England as early as 1830, and a few years later, a 20-mile line of single rail was built in the West of Ireland. A line was proposed to relieve New York traffic congestion in 1873.

Early monorails, however, were laid on the ground, or erected only a few feet above it, with engines and cars balanced upright on them. Such, for instance, was the famous, four-mile long Peg Leg Railroad in Pennsylvania, which opened in 1878 and unfortunately blew up a year later. The Bicycle Railroad—a similar design—skimmed along near Bellport, Long Island at 60 miles an hour, back in 1892. By 1901 an English monorail between Manchester and Liverpool was hitting 100 mph. In 1915 a monorail, elevated two feet above ground, ran between Bartow and City Island, N. Y. And of course for many years a little monorail car has been shuttling United States Senators underground between their office building and the adjoining Capitol.

The most famous existing monorail, however, is at Wuppertal, in the Ruhr district of Germany. Nine and a half miles in length, it is a suspended, overhead type—like the new Houston line. It's been running, without a single fatality among a total of 310,000,000 passengers, since 1902.

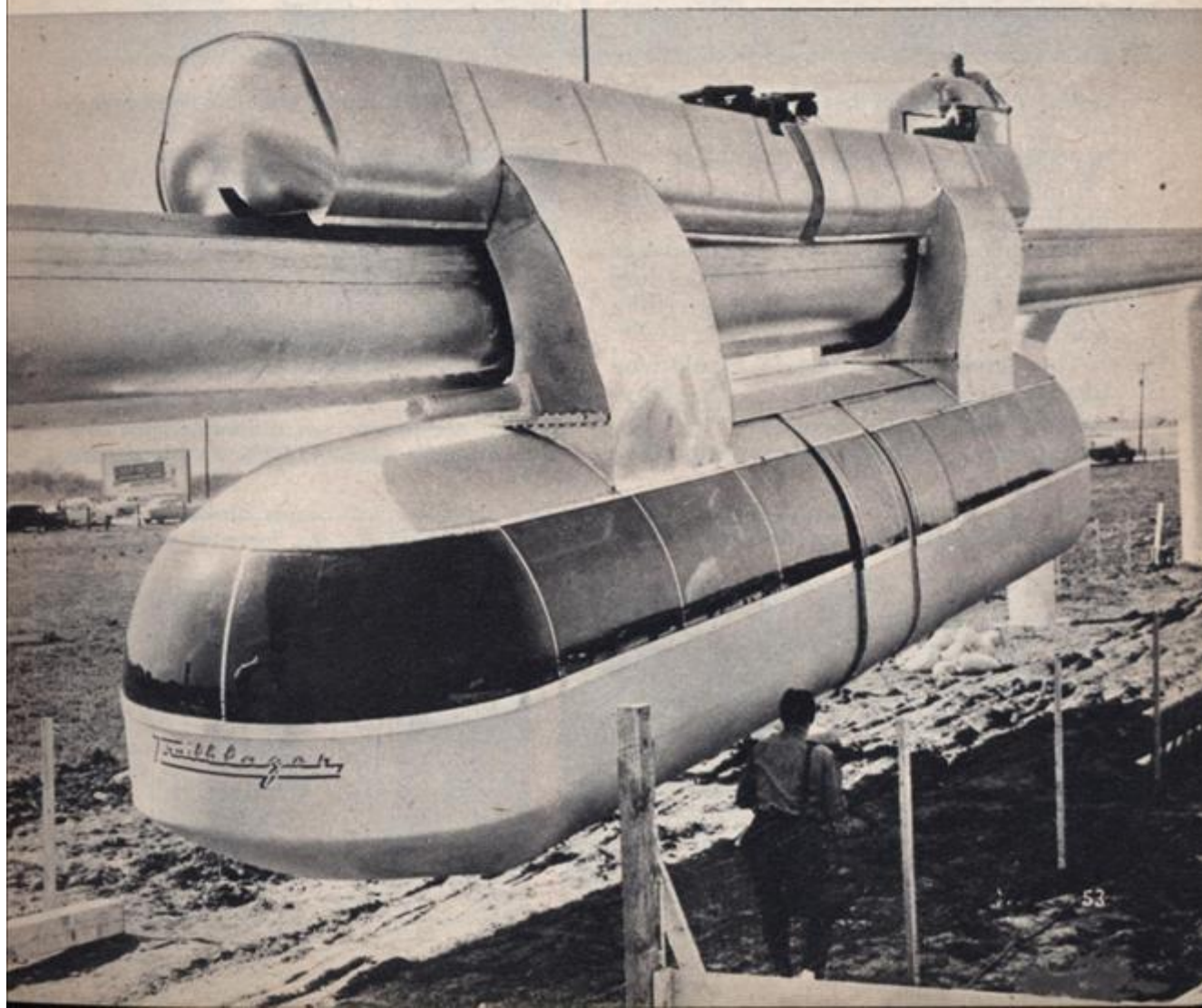
"Overhead, upside-down railroad," though a clumsy phrase, may be a more accurate description of tomorrow's mass transportation than the word "monorail." While the Houston line has just one rail, the Gibbs & Hill design for Los Angeles is actually a narrow-gauge railroad, upside-down with the trains suspended from two rails, three feet apart. This split-rail design, engineers point out, makes switching a lot simpler than the single rail and offers other advantages. Rails, for example, can be enclosed inside a longitudinal box

girder, treated with acoustic material, and they can rest upon a resilient, sound-deadening bed. Gyroscopes would not be necessary in the split-rail design. Even under stress equivalent to a 70-mph wind, the cars would lean less than 10 per cent from the vertical—less than some surface trains as they round a curve at high speed.

Maintenance costs on the monorail should be low. An enclosed track is safe from rain and snow. Brakes and motors on top of the cars are readily accessible for inspection and repairs.

What will it cost to ride it? According to the Los Angeles plan, the rate may be about 2.8 cents per mile which compares with an average nationwide cost of 8 cents a mile for operating a privately-owned automobile. And no more than you pay now to ride a bus or train which is tied to earth. •

Closeup of Houston monorail coach nearing station. Note over-the-rail driver's cab.



Special Section...

40 PAGES OF NEW IDEAS TO IMPROVE YOUR HOME

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

25¢
OCTOBER



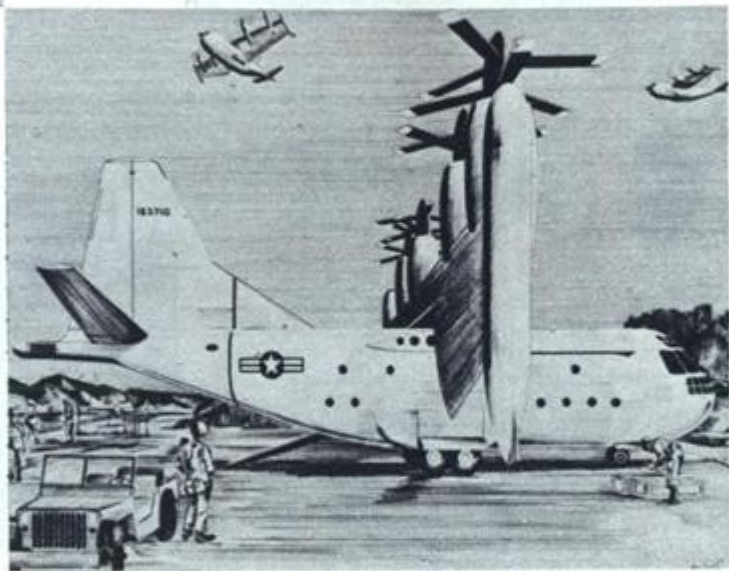
Giant Vertoplane Airliners
Will "Land On A Dime"—Page 98

TOM McCAHILL REVEALS SECRETS OF EXPERT DRIVING
Exclusive! HOW TO GET A \$1000 CASH PRIZE



At right, military craft for vertical takeoff and landing, conceived by Hiller Helicopters.

Below, VTOL, designed by Ryan Aeronautical Co. employs deflected slipstream for takeoff.



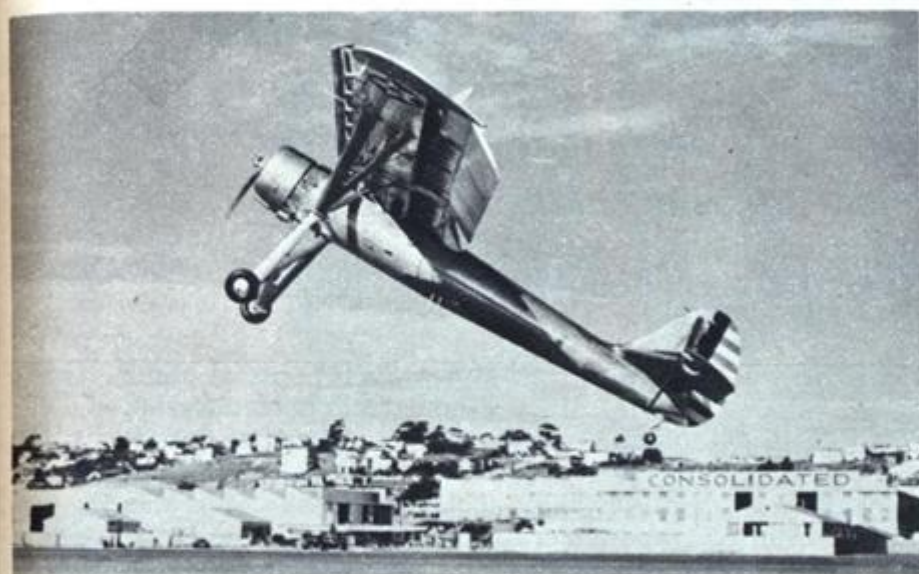
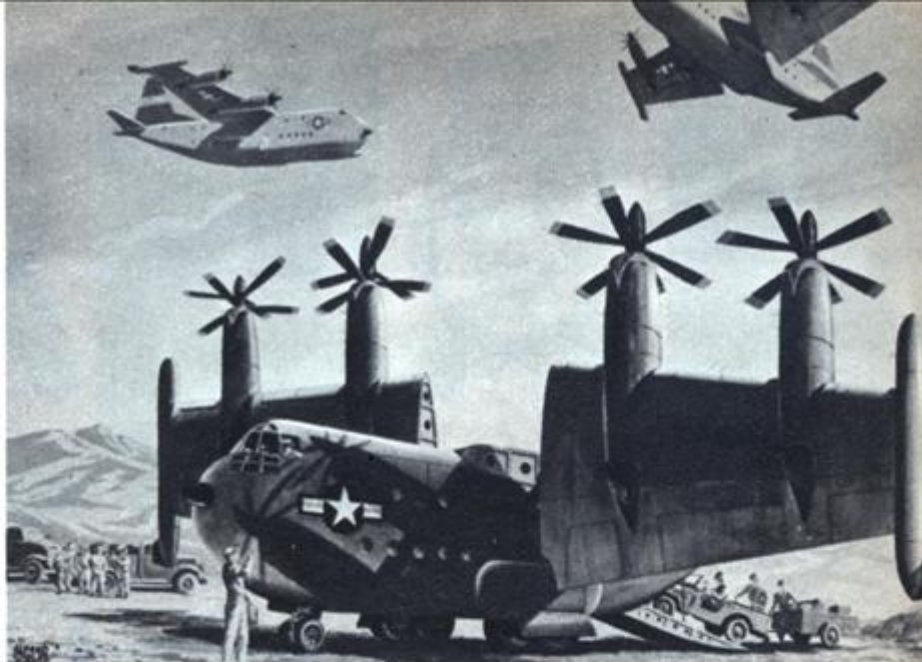
STRANGE-looking craft that take off and land on rooftop airports, operate via automatic flight instruments and controlled by electronic traffic cops are some of the things in store for the air traveler of 1965. Dream stuff? Not according to Civil Aeronautics Administration experts who made the above predictions. Many such planes are already working models or on drawing boards. Limited runway space will mean more and more vertical takeoff and land (VTOL) ships in the air. Passenger planes will have tilting wings and power plants on a horizontal body and will rise and land like helicopters. Skyscraper roofs will be the "fields" for the aircraft of tomorrow. •



COMING: **Rooftop** **Airports**

Runway-less air terminals, VTOL's will greet air travelers of 1965.

Here is another tilt-wing job envisioned by Hiller Helicopters. The craft's wings pivot down when it is in the air so it can fly forward normally.



Ryan's Dragonfly was one of pioneer VTOL ships in 1940. Craft's unique wing had a tremendously broad area and huge retractable flaps that enabled it to get in air after 50-ft. run.

Army VTOL landing on an unprepared area is depicted here by the Vertol Aircraft Corp.

This model of Ryan Vertiplane features an unusual double boom tail construction.



PLAYGROUNDS IN THE SKY

*Here is MI's bold
plan to fight juvenile
delinquency and get
kids off the street.*

By Lester David

THE scene is your city on a sticky, sweltering twilight in midsummer. Lights are beginning to wink on and kids are starting to gather in the streets after the evening meal.

A few years ago this was the danger hour in your city. You remember it well—the nightly muggings would begin about now and young girls would be afraid to venture out alone. Beatings were commonplace and gang wars, fiercely fought with knives and zip-guns, were



a frequent occurrence. But things are different now.

Look at the kids emerging from their homes. Instead of congregating at the candy store and pool parlor hatching up new forms of violence out of boredom, they are now heading for the center of the block. They funnel into a large entrance and are swallowed up inside.

Follow them. They tile into elevators and are whisked upstairs. The doors open and they step into a fantasyland.

There, a few yards from the tenements where they live, on their very roofs,

in fact, is a regulation-size baseball diamond with real springy turf! But the kids aren't interested just now—they played ball all afternoon. Instead, they enter the locker room and in a few minutes are cavorting noisily in a big, broad and very cool swimming pool. Afterwards, they troop onto the ball field, where chairs have been set up, and watch a movie under the stars.

What's it all about? "This magic land for kids doesn't exist in my city," you say. No, it doesn't—yet!

But it darn well could! It could exist in your town and in hundreds of other communities throughout the nation. Every city could construct huge, all-encompassing playgrounds and recreation centers, using the enormous, readily available space now going completely to waste on the rooftops of their congested areas!

The erection of these play centers on the nation's rooftops is MI's plan to counterattack juvenile delinquency. Granted, it's a bold, dramatic proposition. It might also, at first glance, border on the impossible. Immense and breath-taking, yes—but impossible? We don't think so at all.

Does the idea intrigue you? It should because teen-age terrorism is costing you many hundreds of additional tax dollars every year, not to mention the hours of worry for the safety of self, family and property.

Already a million youngsters get into trouble with the police every year. The Juvenile Delinquency Subcommittee of the Senate Judiciary Committee has just made the startling prediction in a report that by 1960 the figure will skyrocket to 2,250,000!

Listen again to the authorities: "If communities throughout the nation provided more wholesome recreational facilities for their young people, delinquency could be curtailed." This comes

ROOFTOP PLAYGROUND would have tennis and handball courts, shuffleboard, model yacht basin, swimming pool which could be used for ice skating in winter, cafeteria, locker rooms. Ball field can be quickly converted for track meets, basketball, etc. Fast elevators would whisk kids to area.



from FBI chief J. Edgar Hoover and his conviction that recreation is a big answer is echoed by judges, child guidance experts and police officials from coast to coast.

MI believes the obvious solution is in rooftop playgrounds. No miracles of engineering are needed. Technically, with the know-how we possess right now, no insurmountable problem exists. Declares Henry Kohler, a prominent New York architect who is editor of the Bulletin of the Brooklyn chapter of the American Institute of Architects:

"Certainly it can be done. Even though roofs are of different heights, even though some buildings are narrower than others, there is no limit to the size of the playground which can be built. You can build a gym up there or you can construct a center big enough for a baseball field, grandstand included!"

Mr. Kohler, who spent four years with the Seabees designing athletic areas of all types for military personnel in the South Pacific, points out that a 200x250-foot center would be ample to contain all the necessary facilities.

The floor would be a reinforced concrete slab built up from the highest level. Let's explain: Suppose the site selected consists of five apartment houses—three of them five stories high, two only four stories high. From the top height of five stories, steel supports could be spanned horizontally, meeting similar supports which come up vertically from the lower height of four stories. The reinforced concrete floor is then constructed upon these supports.

The concrete slab would contain radiant heating units for two major reasons: this is the best way of heating a large area and no other plumbing for heating purposes would be necessary. And there is a third reason which the teen-agers would say leads all the rest: In the winter a refrigerant such as freon could be put into the tubing. This would freeze water and the kids would have themselves a fine skating rink.

Now suppose the roof area of the five apartment houses is too small—suppose the entire area just doesn't add up to a 200x250 playground. Have we met an impasse? Not at all, says Mr. Kohler. The answer: Cantilever out. This means that horizontal supports are extended outward from the edge of the roof and cantilever supports are introduced from the sides of the building.

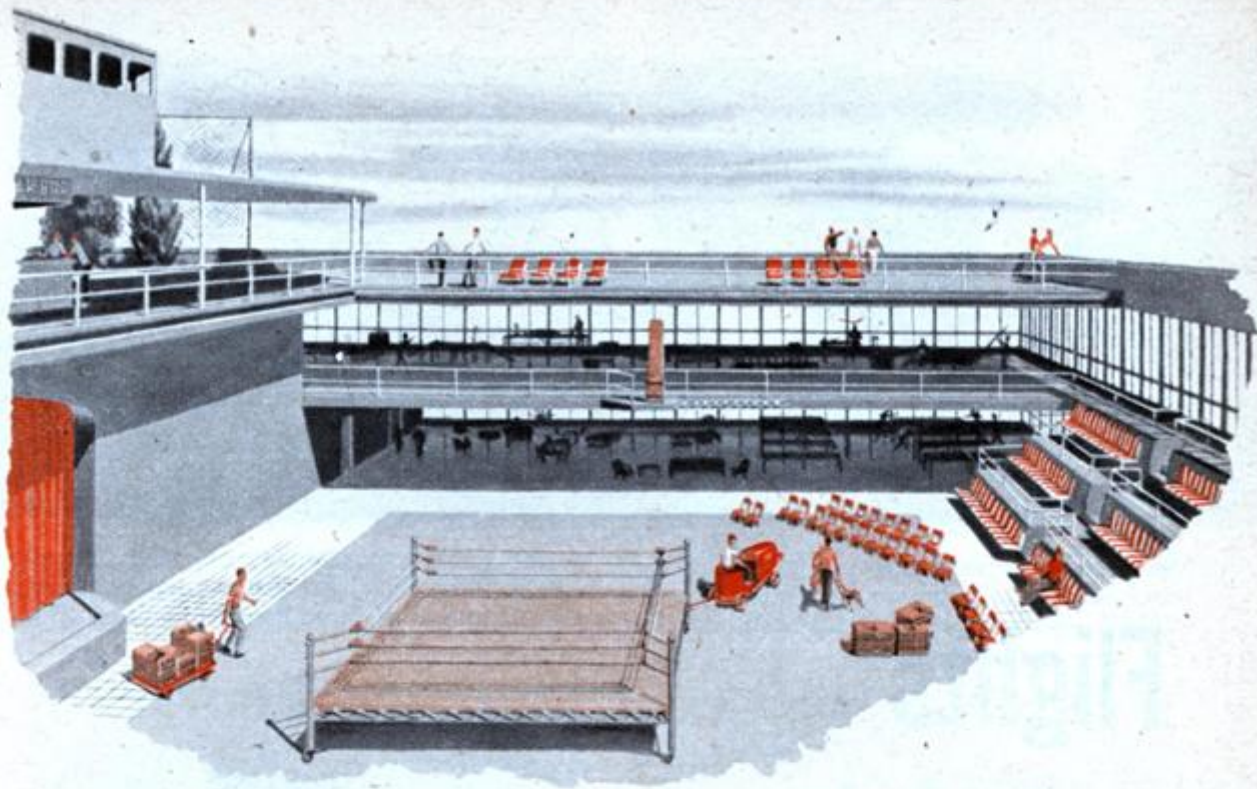
When the dust of construction work clears away, what will the finished product be like?

There would be a baseball field for the playing area. Wooden flooring could be applied in sections over the turf and in a short time the baseball diamond could be transformed into a basketball court, a floor for a track meet or a dance floor. Along the sides removable stands could accommodate hundreds of spectators for neighborhood tournament games.

There would be a swimming pool, showers, locker rooms and even a solarium. There could easily be an ice skating rink in winter, as previously explained, tennis and handball courts, a raised stage for amateur theatricals, ping-pong, shuffleboard and gymnasium

SKI AND COASTING run could easily be constructed for winter sports on baseball field.





BOXING RING set up on roofed swimming pool would give kids plenty of fun, exercise.

equipment.

Off to the sides, behind huge folding doors, there could be separate, smaller rooms. These would be studios for arts and crafts, painting, sculpture, photography, music and rehearsals. There could be a wood and metal working shop, a library and study rooms.

The total cost for a playground like this? An estimated \$1,000,000, and a bargain at the price.

There would be some problems to surmount, of course. Legal questions, such as liability in case of accidental injury, would have to be straightened out in advance. Zoning problems would have to be handled. Code requirements of the local departments of housing and buildings would have to be met. Money must be raised.

Recently, four reform school teenagers appeared before a youth forum in New York and, sitting behind a screen to protect their identities, advised their elders on how to deal with kids. Their unanimous conclusion: More young people would stay out of trouble if they were loved by their parents and "had decent and interesting places to play after school."

Anyone who has ever had a taste of the misery, degradation and boredom of

an alley adolescence can testify that this is a realistic suggestion. The clincher came when the New York State Attorney General told the youths that their suggestion was the same as that offered by a panel of social workers and public officials not long before at a hearing on the problems of juvenile delinquency.

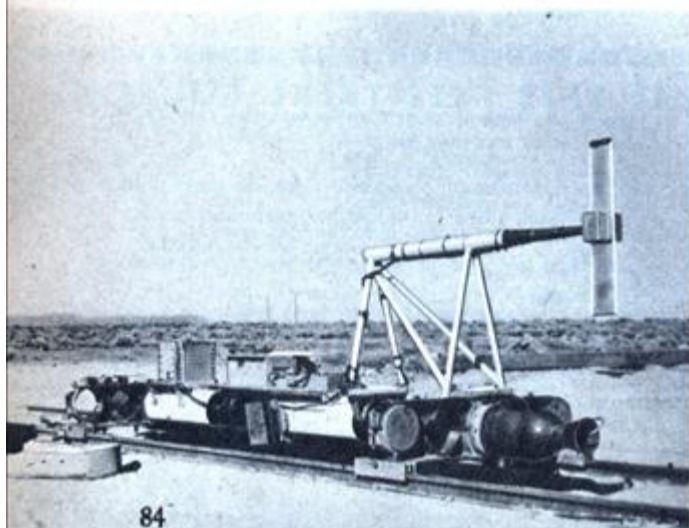
How about it? Had a bellyful of terror in your city's streets? Then why not give rooftop playgrounds some long and serious thought? •

MOBILE BLEACHERS would provide seats for watching plays, movies, sporting contests.





Rocket Train Faster than Sound

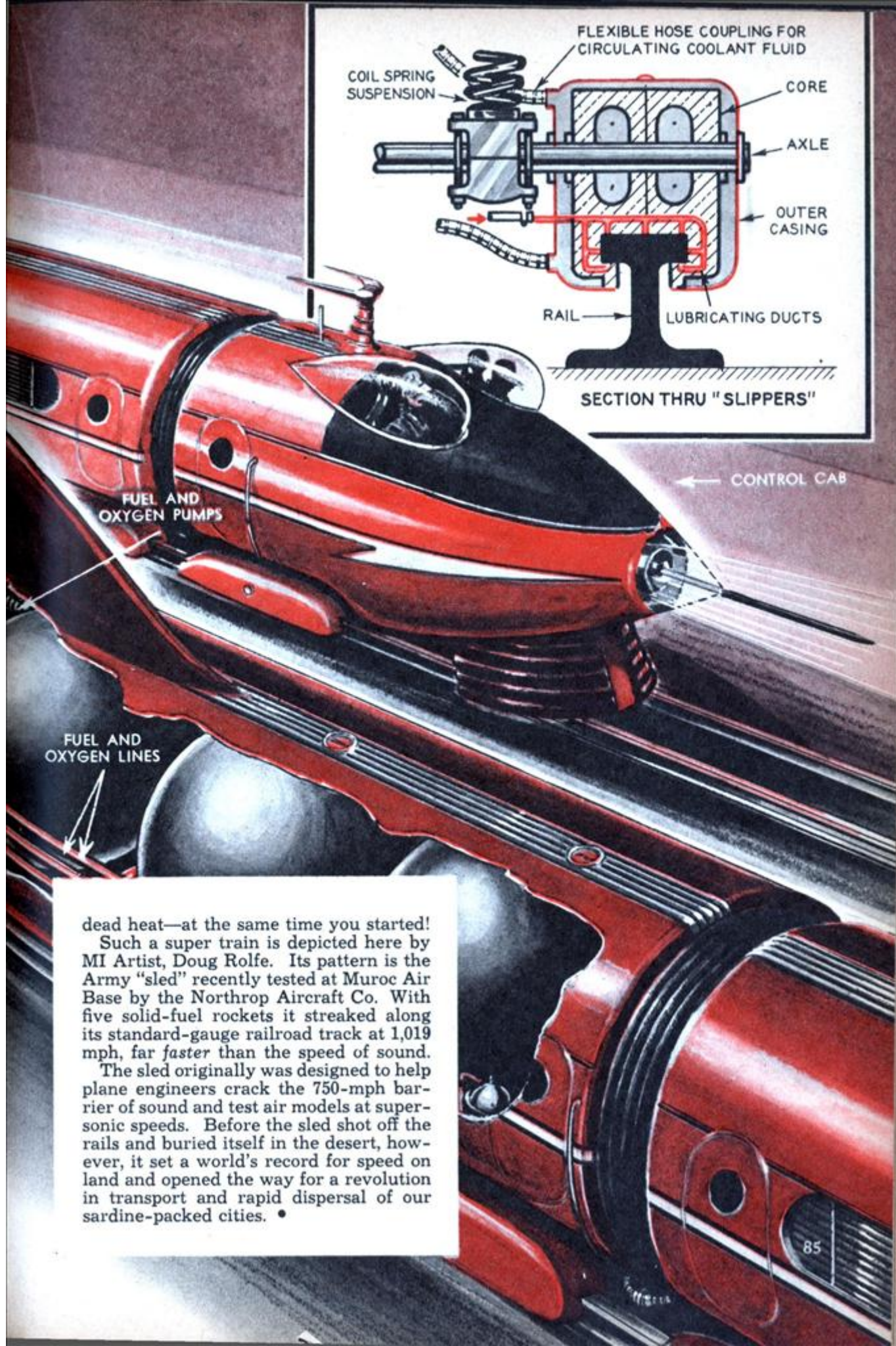


TOMORROW'S train will be too fast for a timetable. Leave New York at 12 noon for the coast, and you'll arrive in Los Angeles at *the same time, the same day!*

How's that? At 1,000-mph your train will travel as fast as the sun in its apparent motion across the earth from east to west. You'll pace the sun through every time zone from Eastern Standard to Pacific Time as your wheel-less train glides across the continent in three hours on its graphite-lubricated slippers. It'll take the sun three hours to race the same distance, and you'll flash into L.A. in a

This supersonic sled serves as an "outdoor wind tunnel" for model "wing" on boom at front end.

Mechanix Illustrated

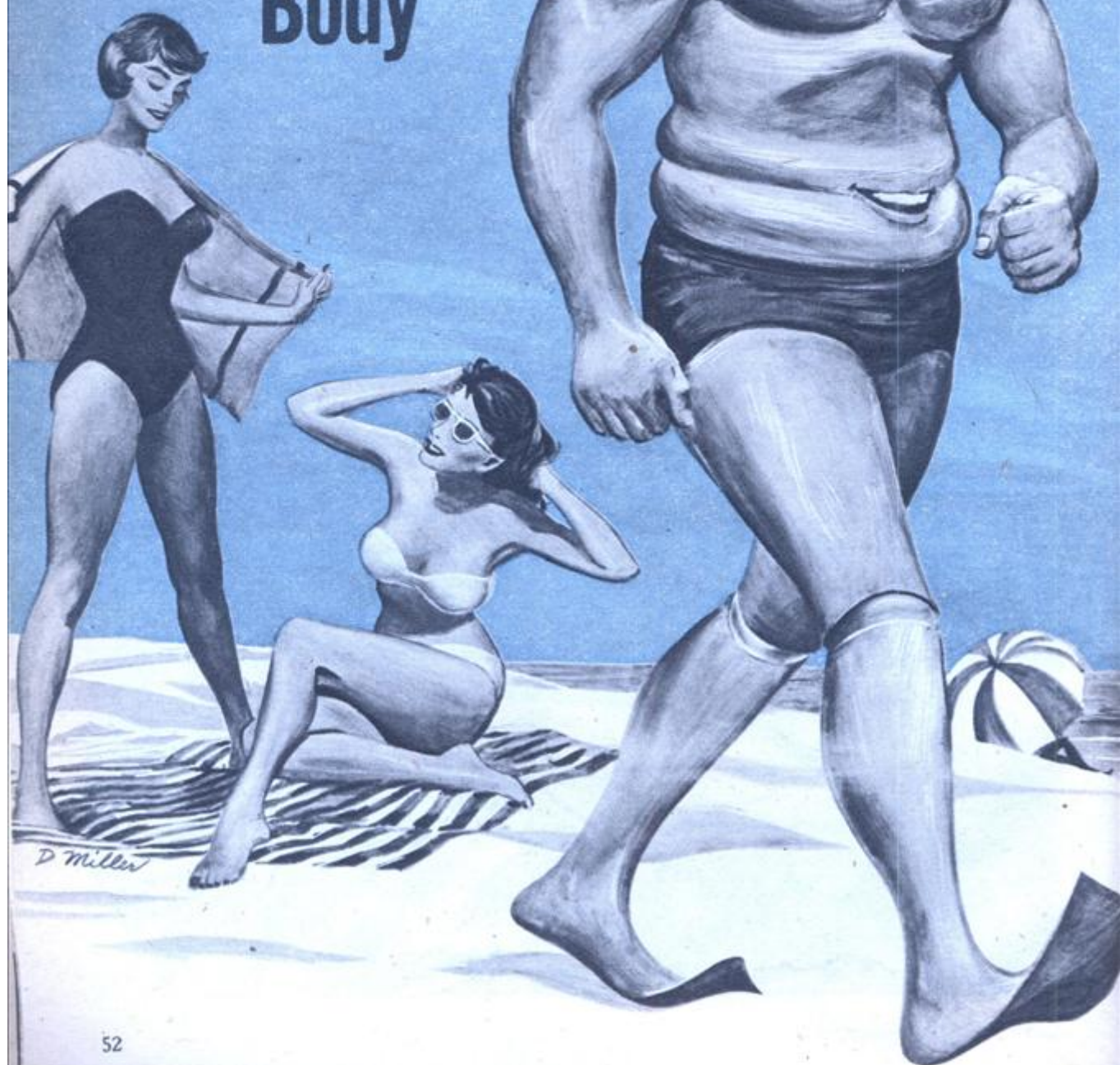


dead heat—at the same time you started!

Such a super train is depicted here by MI Artist, Doug Rolfe. Its pattern is the Army "sled" recently tested at Muroc Air Base by the Northrop Aircraft Co. With five solid-fuel rockets it streaked along its standard-gauge railroad track at 1,019 mph, far faster than the speed of sound.

The sled originally was designed to help plane engineers crack the 750-mph barrier of sound and test air models at supersonic speeds. Before the sled shot off the rails and buried itself in the desert, however, it set a world's record for speed on land and opened the way for a revolution in transport and rapid dispersal of our sardine-packed cities. •

Science Redesigns the Human Body



*Some scientists, engineers and designers gripe about
Nature's masterpiece and suggest a few improvements.*

By Lester David

ON A golf course last Fall, a New York accountant took a healthy swing at the ball, fell to the ground—and couldn't get up. He spent the next nine weeks in a hospital. Slipped spinal disc.

A mailman in Philadelphia was forced to turn in his resignation when fallen arches made walking unbearable.

In Chicago, an office worker running for a bus suddenly crumpled to the ground. He hobbled to a stoop and sat until help arrived. Dislocated knee, the doctor said.

Multiply each of these instances by several million and you will get a rough idea of the number of bad backs, sore feet and trick knees which abound in this country alone. It all adds up to the fact that, while the human body has never been equalled from the standpoint of all-around master engineering, a number of glaring weaknesses do exist in man's basic equipment.

Listen to Dr. Wilton M. Krogman, professor of physical anthropology at the Graduate School of Medicine, University of Pennsylvania: "It has been said that man is 'fearfully and wonderfully made.' I am inclined to agree with that statement especially the 'fearfully' part of it. As a piece of machinery we are such a hodgepodge and makeshift that the real wonder is we get along as we do."

How would scientists go about redesigning the human creature in order to get the most efficiency out of him?

MI tossed the intriguing problem into the laps of anthropologists, physiologists, engineers and industrial designers.

We got some fascinating answers!

Perhaps the most unusual came from George M. Rowland, Jr., president of Burdick-Rowland Associates, a nationally prominent firm of industrial designers.

"From the standpoint of load-bearing over a long period of time," he asserted, "a basic weakness exists in man's spine." Many doctors and anthropologists agree, pointing out that man's spine was fine when he was getting along on all fours a million or so years ago, but the upright posture puts an undue weight on it.

"The result," Mr. Rowland stated, "is that the spine now curves and sags and frequently gets out of kilter. From a designer's point of view, I see no reason for a disjointed spinal column. Why not encase the spine in a tube of semi-flexible cartilage? Thus man's spine would be a solid column, with a greatly increased load-carrying capacity. In addition, the vital nerves in the spine would be more fully protected against injury. Man would not be able to twist and turn as he does now but the semi-flexibility of the cylinder would allow enough bending for every ordinary purpose."

"And why," asked Mr. Rowland, "couldn't the brain be situated in the chest cavity, near the heart? Nearness to fuel supply is a fundamental principle in industry, so why not here?" There is another factor—if the brain were in the chest, it would be far less vulnerable to injury.

Man's shape, then, would be altered rather drastically: The head would be a mere conning tower, probably be cylindrical, and the chest would have to be bigger. While redesigning the thorax

Cylinder-head digging the conventional-type girls with his back eyes has his brain in his outsize chest, his mouth near entrance to stomach. Other advanced features: moveable trumpet ears with radar antennae behind them; heavy-duty midsection muscles; congestion-proof snout; strong, flat, toeless feet; no nasty hair.



This arrangement would not only be beneficial on patriotic occasions but you could glare at people out of your accusing finger.

Mr. Rowland brought forth another fairly radical suggestion: "Why is it necessary to have individual ribs? Why can't man's internal organs be protected with a device resembling a giant clamshell which can be opened easily for surgical purposes, be flexible enough to permit breathing and which would protect the vital organs a good deal better than the present lattice-work arrangement?"

Robert M. Wolff, an engineer and vice president of the Wolff Appliance Corp. of New York came out for an extra set of eyes in the back of the head.

"At present," he said, "a human being's range of vision is at most 180 degrees and it's often much less than that. Why shouldn't man's vision be increased to a full 360 degrees?"

Ben Fromkin, a designer with the Burdick-Rowland firm, points out that man has trouble picking up small sounds emanating from the rear. Thus footpads, automobiles and falling objects may strike from behind without warning.

Why, asks Mr. Fromkin, couldn't antennae be concealed in the head? These could pick up sound waves, lights and shadows, and relay them to the brain. The suggestion is not plucked from the blue—grasshoppers and other insects have them.

Professor John L. Landgraf of the New York University anthropology de-

partment would like to see additional muscle strength across the lower abdomen to support the weight of the internal organs. This, he declares, might result in a thicker waistline, a fact which might dismay the girls, but it wouldn't be too thick, and there would be no more pot bellies.

Another anthropology professor would widen the pelvis considerably, creating an anatomical construction something like the bustle of the last century. Powers models wouldn't care for it, but the wider base would eliminate the present strain and the risk of hernia. And childbearing would be immeasurably easier, he asserts.

How about teeth? Declares British biologist Haldane: "Our teeth suffer from overcrowding, and that is one reason why they so often decay." Haldane points out that man is probably evolving toward fewer teeth. "A good many people," he says, "never cut their wisdom teeth and perhaps none of our descendants will." Dentists consulted by MI agreed that 20 teeth would be an improvement over the present 32.

How about hair? Dr. Marion B. Sulzberger, one of the world's foremost dermatologists, wrote recently that the "cost of upkeep of a nation's hair may perhaps rival that of a nation's army." Some scientists believe that man is

Feel like a jerk when your hat blows off? Well, how'd you feel if suddenly little hands came out of your head to catch it?





It's silly to feel silly about bat wings. If you have them, you have them—and very handy they are on our crowded city streets.

gradually evolving toward baldness anyway, as indicated by the gradual disappearance of hair on the rest of the body. Therefore, they say, why not get rid of the useless stuff now?

How about feet? Much too weak to support the rest of the body. Mr. Con-
tini of N. Y. U. says the human arch could stand redesigning for added strength and durability. Mr. Rowland doesn't see any need for the little toe and even for toenails. Originally they were claws, he says, but now they serve no purpose and often cause trouble.

How about knees? Doctors assert that something should be done about the knee's habit of slipping out of whack, but anthropologists said there was no simple solution. Several suggested additional, stronger muscles. Most agreed that tampering with the knee joint might give it greater strength but would restrict its present freedom of movement.

In addition to these suggestions, the interviews resulted in a wild assortment of other ideas, many meant frankly for fun:

Why not wings to enable man to get around (or over) the miserable traffic situation? Why not protective covering for the eye, containing substances which would screen out harsh ultra violet rays? Why not built-in pockets, such as kangaroos have? Why not a small food storage compartment like the camel's? Why not design the neck so

that a human being can turn his head completely around?

From Raymond Loewy, the world-famous industrial designer: Not long ago, Mr. Loewy recalls, comedian Tom Ewell launched in a series of beefs about the body's inadequacies. He suggested certain improvements, such as an eye on the end of the finger for looking over the heads of crowds. Mr. Ewell thereupon challenged Mr. Loewy to add other features and the designer and his staff took up the gauntlet. Reports Mr. Loewy: "We put hooks on heads for strap-hangers on subways who wanted to read the papers and we tried an extra pair of hands coming out of ears to hold hats in high winds."

From an architect: "Man's nose is a weak point. Air going into the lungs must make a hairpin turn in the nostrils; the results are several kinds of sinus troubles and what-have-you. So why not a long snout to help do away with this awkward turn and the resultant ills?

From a radio engineer: why not folding ears something like the old-fashioned ear trumpet to catch low-pitched sounds?

We called a halt to the investigation when one famed designer came up with this:

"Why not detachable arms so that you can sleep in comfort, a spare, smaller-sized head in case your hat shrinks and a small hand in your back so that you can scratch hard-to-reach itches?" •

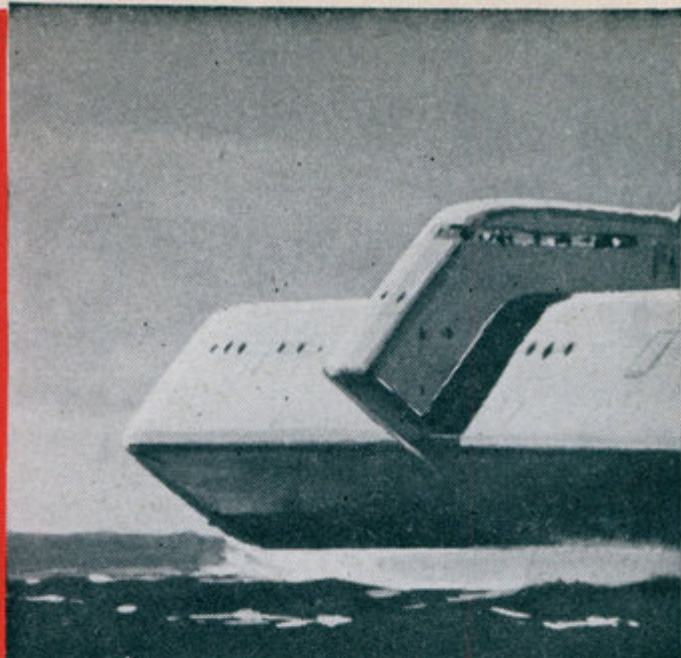
One suggestion is to replace flimsy rib cage with stronger clamshell chest structure that opens easily for repair work.



The Sea-Gem:

a 100 mph Air-Cushion Ship by 1963

By JAMES JOSEPH



NON-ELECTION year 1963 may nevertheless bring a spectacular inauguration.

Some time next year, America's first air-cushion ship, the Sea-GEM (for sea-going ground effect machine) may streak New York to London on her maiden "flight."

Riding 3 to 6 ft. above the waves on a frictionless cushion of air, the giant 100-ton craft will be propelled at better than 100 mph by four jet-prop pusher-type engines.

Part ship, part plane, and wholly revolutionary, the Sea-GEM promises its 100 first-flight passengers some surprises.

Your seat-belt cinched, you'll scarcely notice when the aluminum and stainless steel craft makes the transition from land to water. Though you'll be "airborne," the ocean will

be but a yard or two below you. Between you and the sea will lie nothing but air—a low-pressure air cushion churned into being by the Sea-GEM's dual horizontal fans. "Afloat" but almost "flying," you'll feel no sea-sensation, no roll or pitch. Nor will the thundering jet engines (a total 22,000 hp) be audible through the aircraft-like hull. Thirty super-smooth hours after leaving New York, you'll "land"—actually, slide up a ramp—in London.

The figment of a naval architect's imagination?

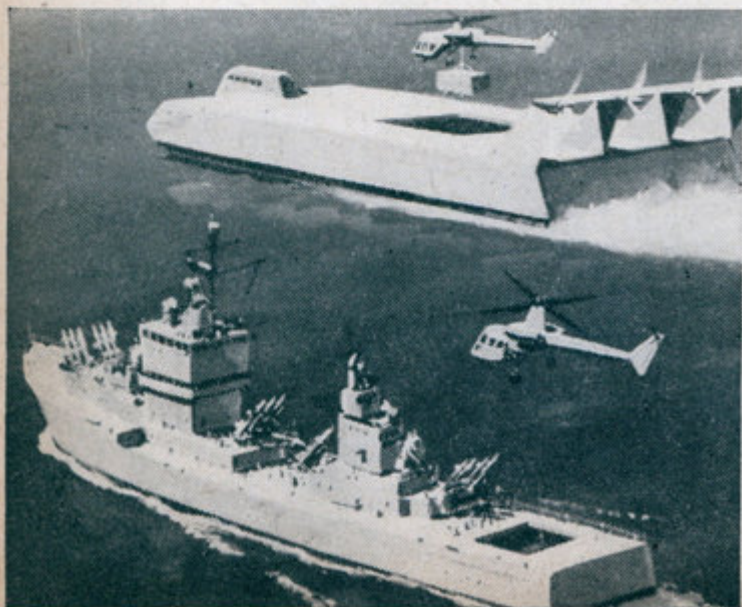
Not at all. The U.S. Maritime Administration announced recently that it's negotiating a \$370,000 Sea-GEM design-study contract with Vehicle Research Corp., Pasadena, Calif., and its subcontractor (and probable Sea-GEM builder), big Douglas Aircraft Co.

The Maritime Administration's admitted goal: to launch the craft by 1963.

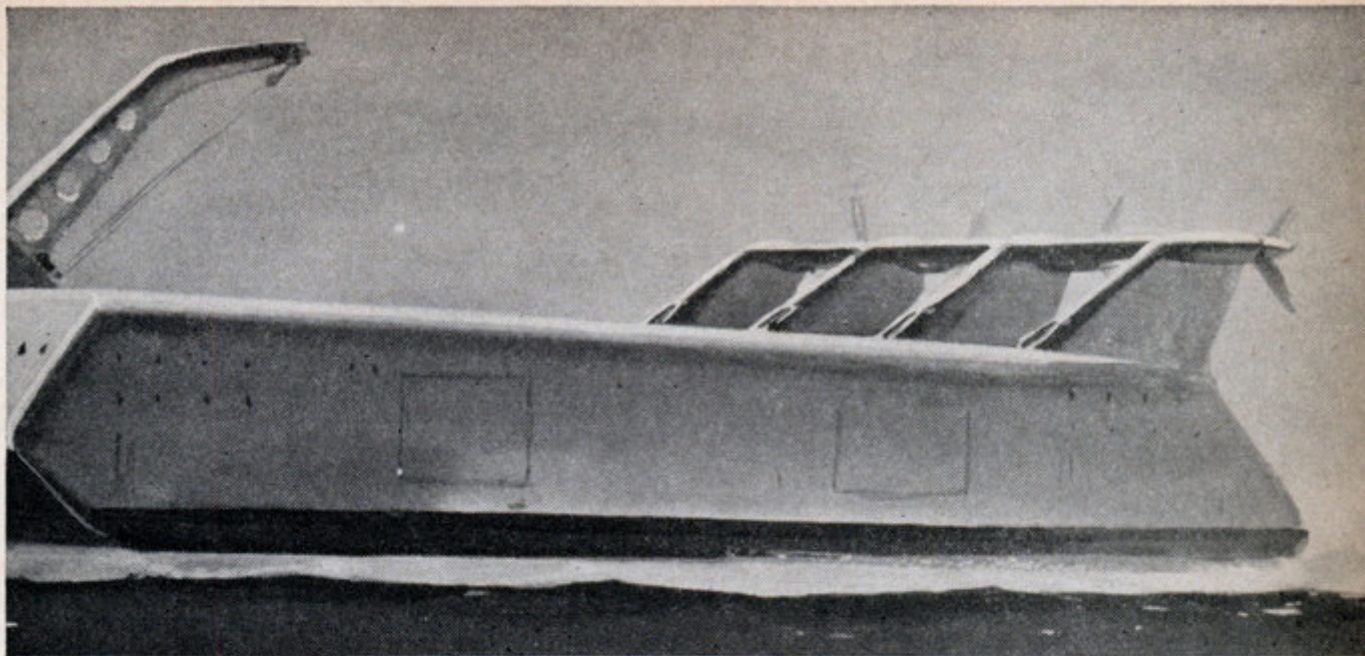
"We've been at work on the project for some time now," confirms Dr. Scott Rethorst, Vehicle Research's president and one of our country's foremost aerodynamicists.

The first Sea-GEM probably will be the 100-ton model, but Douglas Aircraft's president, Donald W. Douglas Jr., recently indicated there is almost no size limit. He pegged as "most efficient," sea-skimmer ships in the 500- to 1000-ton class.

The Sea-GEM, although using the



Cargo could be transferred from Sea-GEM by crane-helicopters operating from its flat deck.



same air-cushion principle (see page 73, June '60 S&M), will resemble neither Britain's now abuilding 25-ton SRN-2 (which is powered by four turbine engines) or several U.S.-sponsored GEM-vehicles, including the now-declassified Avro craft. Pentagon insiders say the Avro failed, in wind-tunnel tests, to meet military altitude specs.

In contrast to the Avro, the Sea-GEM will, at most, skim the water, its great weight supported by the cushion of air (only about $\frac{1}{4}$ psi, or 36 lbs. per square foot). Douglas estimates that even a 500-ton craft would operate about half of the time at just 3 ft. or less above the surface—closer in calm seas; higher, and probably slower, when it's rough.

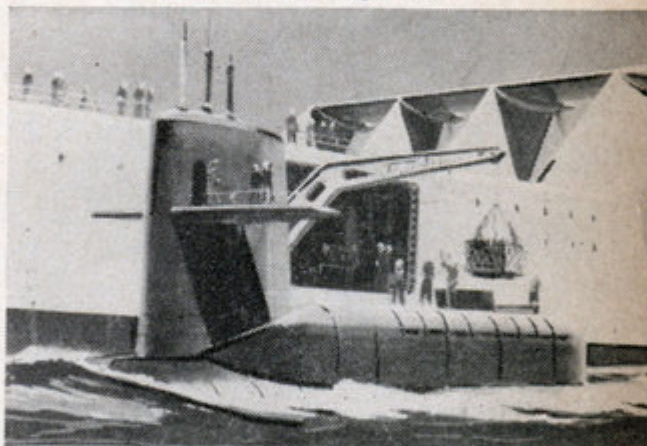
For its main propulsion, the craft will depend on its four jet pusher engines. But propulsive power, even for the 500-ton ship envisioned by Douglas, won't need to be anywhere near as big as for either jet planes or helicopters. Reason: The jet engines' total power is translated into thrust; none of it (as in aircraft) is squandered on lift.

Artist's drawings of the first 500-ton craft confirm Donald Douglas's statement that "the craft's configuration will tend toward a low, functional profile with essentially straight-line elements which permit the structure, although aircraft type, to be simple and low in cost."

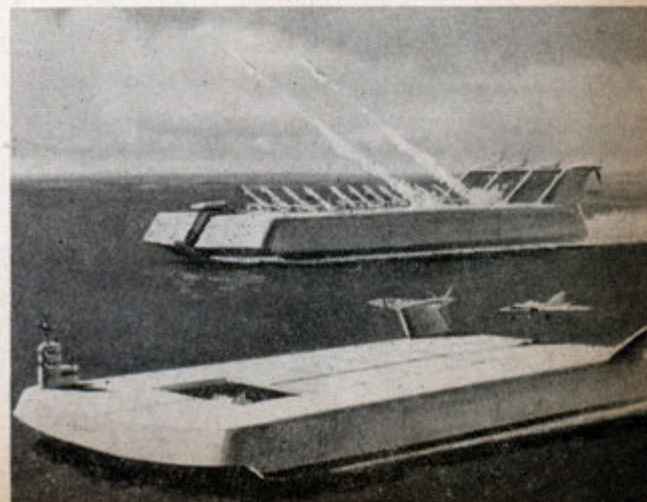
Although the Maritime Administration's underwriting of the first Sea-GEM ostensibly aims at faster, more economical over-water transport, the Navy is also eyeing the craft as a multi-functioned amphibian: a land-to-water assault and supply ship.

Here's the Sea-GEM as an aircraft carrier (foreground) and a missile-cruiser. As a carrier, it has engines mounted outboard, with its control tower far to starboard.

The 500-ton cargo-passenger Sea-GEM will look like this. Jet-prop aircraft engines are mounted astern. Vertical tail might have movable control surfaces for steering. Control cabin is mounted in the center of the bow, as is cargo crane.



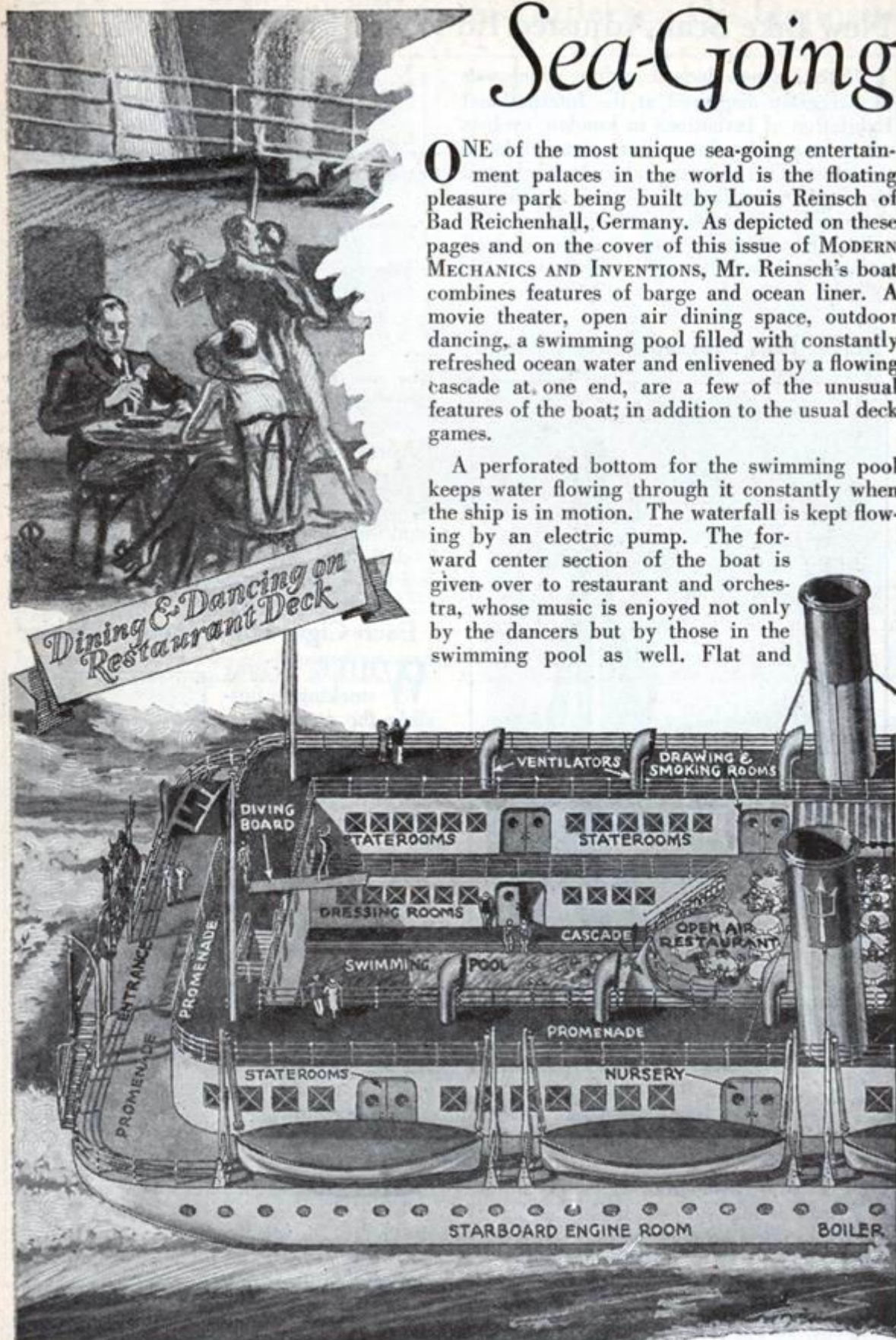
Rushing to a supply rendezvous with a nuclear sub, Sea-GEM could land in water or remain airborne (to reduce chance of sonar detection by enemy sub) to resupply friendly sub while both maintain cruise speeds.



Sea-Going

ONE of the most unique sea-going entertainment palaces in the world is the floating pleasure park being built by Louis Reinsch of Bad Reichenhall, Germany. As depicted on these pages and on the cover of this issue of MODERN MECHANICS AND INVENTIONS, Mr. Reinsch's boat combines features of barge and ocean liner. A movie theater, open air dining space, outdoor dancing, a swimming pool filled with constantly refreshed ocean water and enlivened by a flowing cascade at one end, are a few of the unusual features of the boat; in addition to the usual deck games.

A perforated bottom for the swimming pool keeps water flowing through it constantly when the ship is in motion. The waterfall is kept flowing by an electric pump. The forward center section of the boat is given over to restaurant and orchestra, whose music is enjoyed not only by the dancers but by those in the swimming pool as well. Flat and



The features of the sea-going pleasure park are well shown on this drawing by Stewart Rouse.

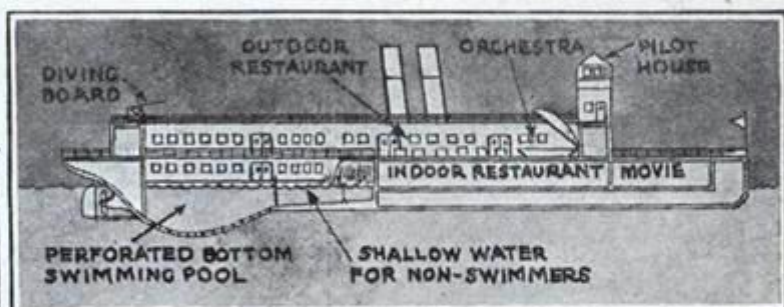
Pleasure Parks

*Outdoor Sports
on German Floating
Amusement Palace*

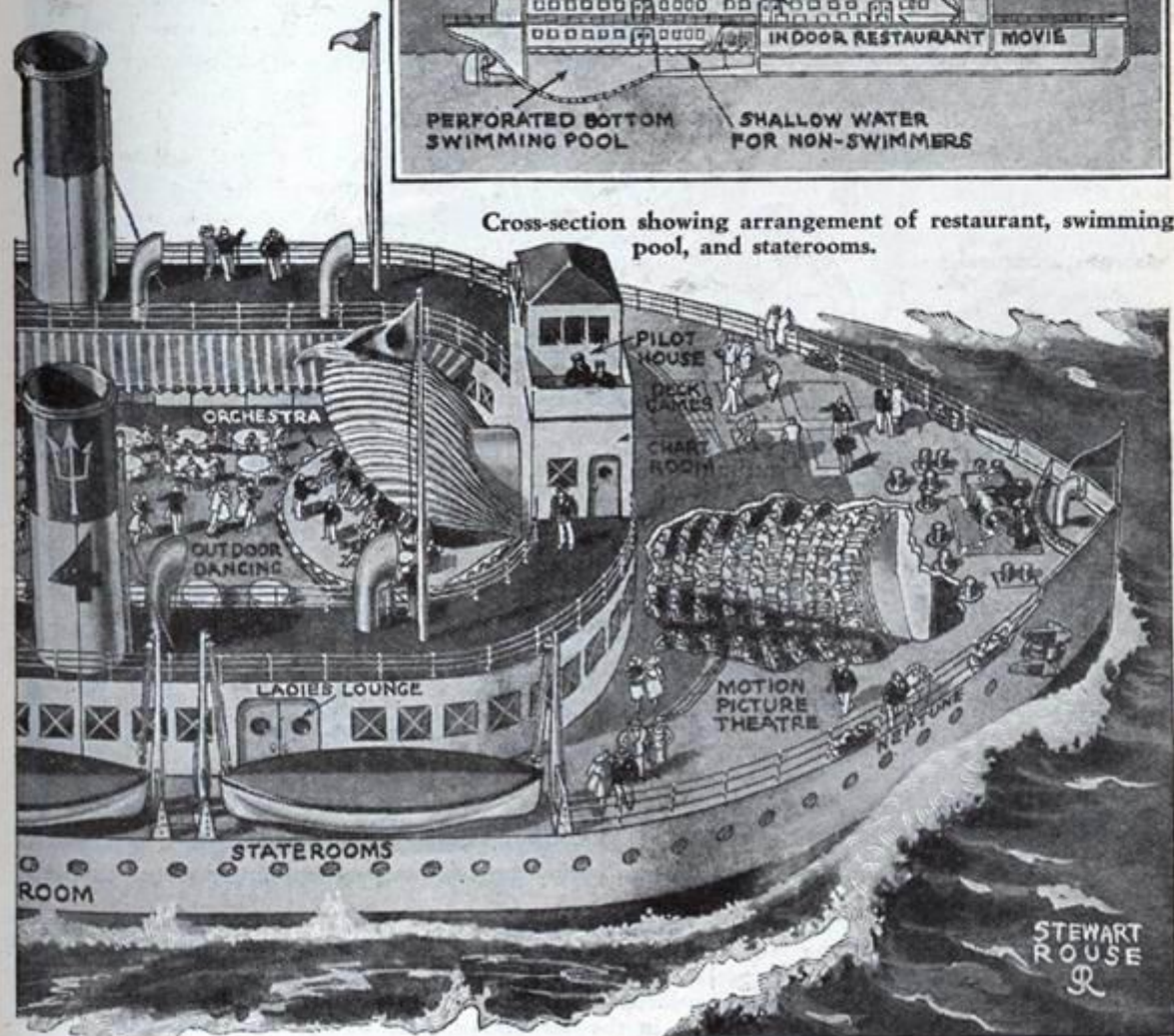
wide in construction, the craft is not designed for speed, but for leisurely cruising in coastal waters. It is not intended that the barge should ply far from shore, since the changing land scenery is one of the features which appeals to passengers out for a holiday, but the ship is perfectly seaworthy and in case of necessity can ride out the roughest sea in mid-ocean.

Since the center of the ship is entirely occupied by restaurant and swimming pool, the designers were faced by the necessity of installing the funnels from the boilers on the sides of the boat. These funnels are taller than ordinary, so the

smoke will not interfere with the pleasure of the passengers. As being built by Mr. Reinsch, the boat will accommodate 750 passengers, including the crew. The first boat constructed will probably be put into service on the French Riviera. Owing to its shallow draft, it is perfectly possible to cruise navigable rivers, and excursion trips up the Rhine, with its beautiful scenery and ruined castles, are contemplated. The first of Mr. Reinsch's unique ships will be put into service next summer, it is hoped.



Cross-section showing arrangement of restaurant, swimming pool, and staterooms.



Note that practically the entire deck of the floating palace is given over to entertainment of passengers.

October
...
MODERN
MECHANIX
& INVENTIONS MAGAZINE

NOW
15¢
IN CANADA 20¢



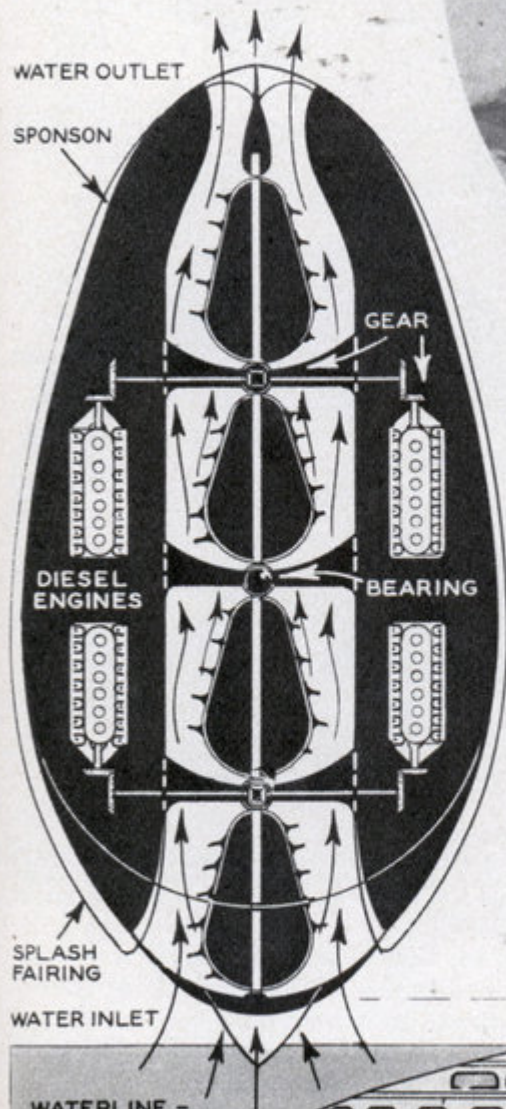
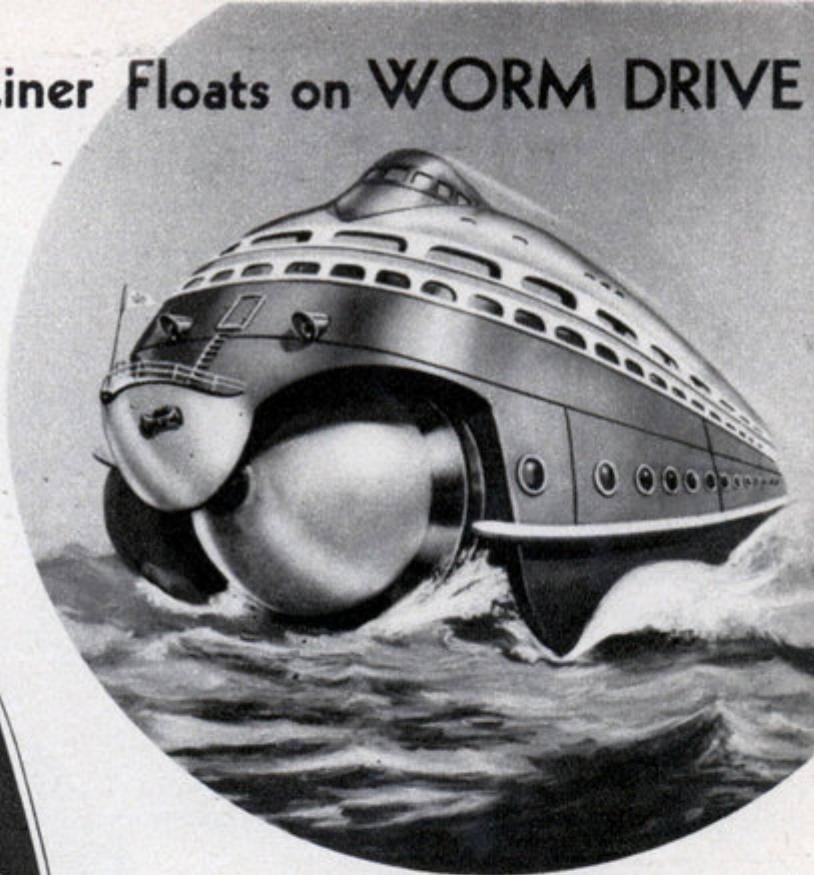
SEA SLUG LINER
SEE PAGE 82



Flying Without Wings or Motors

"SEA SLUG" Liner Floats on WORM DRIVE

Like a giant turtle this odd ocean craft slides through the waves. It is designed to increase speed and comfort and to reduce costs of ocean travel.



COMBINING speed and comfort with modern streamline design, the "sea slug" liner employs an unusual means of propulsion. Instead of the screw propeller drive used on ocean ships, this craft is driven by a series of worm screw impellers.

These impellers also eliminate the common hull design. The center portion of the ship is hollowed out for the series of four worm screws. The sides of the hull float and with the hollow screws provide buoyancy for the liner. As speed of the ship increases, the hull rises, lowering its resistance in the water.

Passenger cabins are arranged along the completely enclosed promenade decks, with the large cargo holds built into the vibrationless hull parallel to the engine rooms.

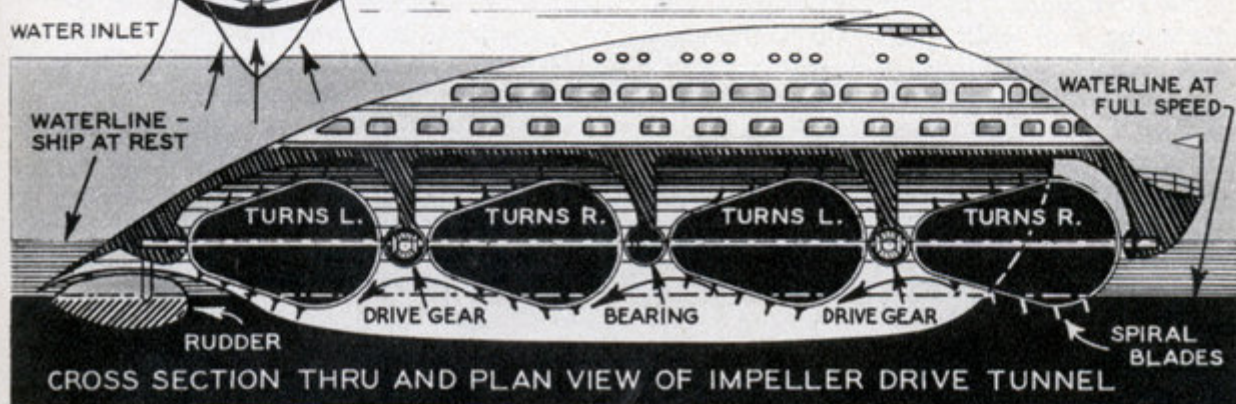


Photo at top shows how liner would appear at sea. Diagram above shows location of cabins in upper part of hull. Diesel motors are placed in lower section. Screws revolve in opposite directions to avoid tendency of ship to drift sideways.

MODERN MECHANIX

AND INVENTIONS

SEPT

NOW
15¢
IN CANADA 20¢



SEE PAGE 63

Building Speed Planes *for*
World's Greatest Air Race

Sea Waves to Drive Ocean Liner



R. J. May's "whale mouth" ship will present this unusual view from the forward end. Within the mouth can be seen the observation windows. Along the sides are the water spouts.

RESEMBLING a ferocious monster of the deep, an ocean liner is being designed in Germany to make use of the sea's unlimited energy as a propelling medium.

The ship will have an opening in its bow that will give it the appearance of a giant whale swimming over the water with its jaws ready to devour anything in its path. This opening will gather up the ocean waves and pass them through the ship. The water will be ejected by means of spouts along the sides of the liner. The water, forced out under pressure, is expected to drive the ship forward at great speed. As a result the expense of operating a liner is expected to be reduced.

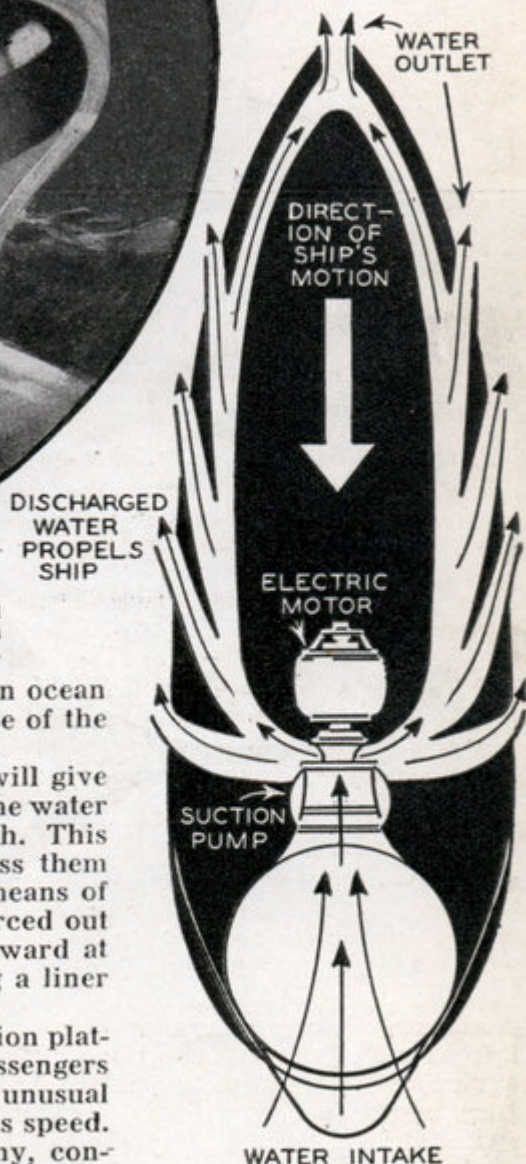
Within the mouth of the ship will be an observation platform and a row of windows, through which passengers may watch the waves surging into the hold. The unusual liner will be thoroughly streamlined to increase its speed.

R. J. May, an engineer of Pirna, Elbe, Germany, conceived the idea for the novel ship. He plans to install a large suction pump at the rear of the liner's mouth. This will draw up the water and force it under great pressure through pipes to the spouts along the sides. The electric motor driving the fan will be powered by a Diesel engine.

May plans to build a model this fall. It will be tested on the Elbe river near Dresden, capital of Saxony. If tests prove successful, the engineer will seek to interest steamship companies in his project.

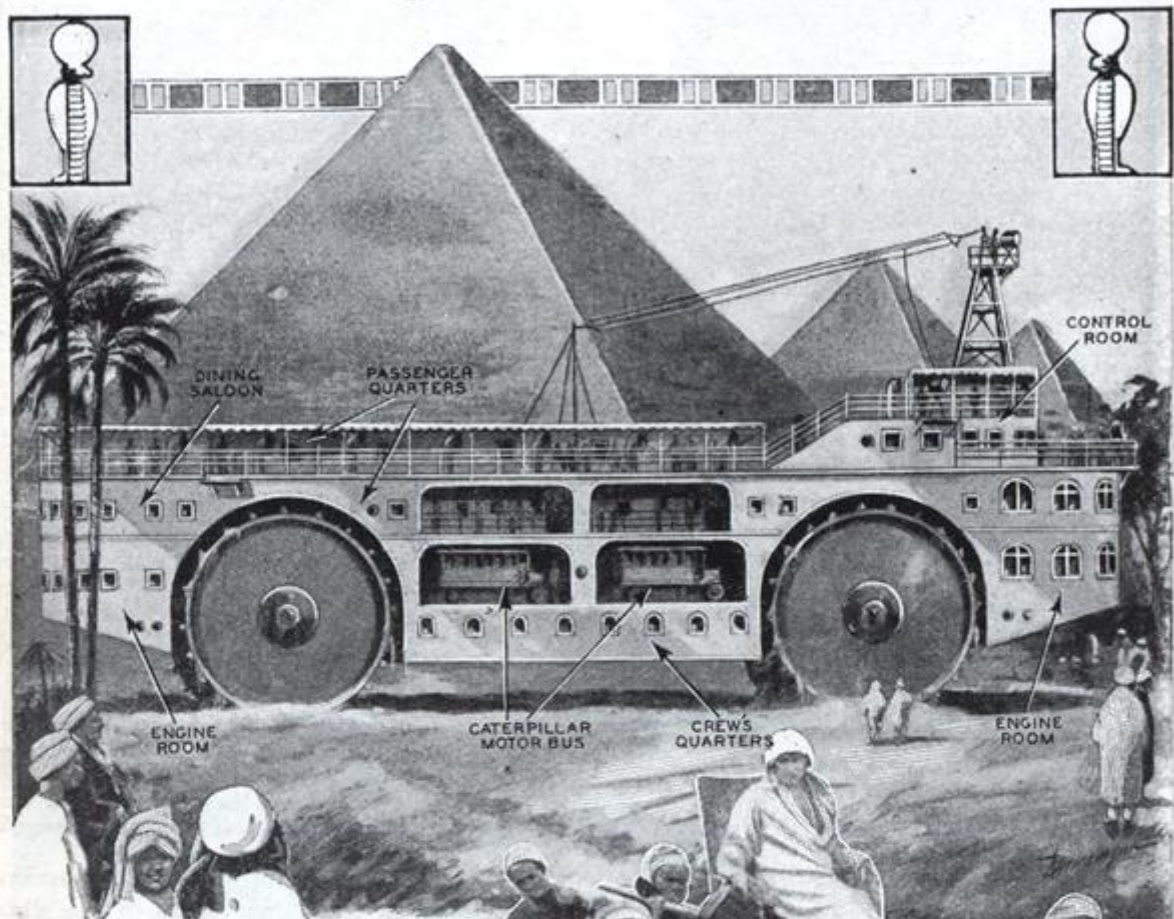
Unlike the ordinary liner which has propellers at the stern only, May's ship will have nine points of propulsion. These are the nine spouts located at the sides and stern.

German engineer plans to build novel "whale mouth" ship using water as propelling medium.



Ocean waves will be drawn up into water intake as shown in the above plan drawing. An electric-Diesel drive will propel the suction pump. This pump will force the water into pipes which lead to the nine spouts at the sides and stern of the ship. The pressure of the water leaving the spouts will drive the liner forward in the direction shown by the arrow. The ship's unusual motive power and its streamline construction is expected to reduce operating costs and result in greater speed than is possible with present liner. The designer plans to test a model this fall.

SHIPS of the DESERT



Above is an artist's conception of the gigantic "Ship of the Desert" as drawn from a description of the vehicle. The ship will have a cruising range of 6,000 miles with 56 passengers and crew of 11.

JUST as the horse has been ousted from the streets by the ubiquitous automobile, so the camel, for centuries known as the "Ship of the Desert," seems doomed, if the plans of a prominent engineer of Kiel, Germany, are carried into effect.

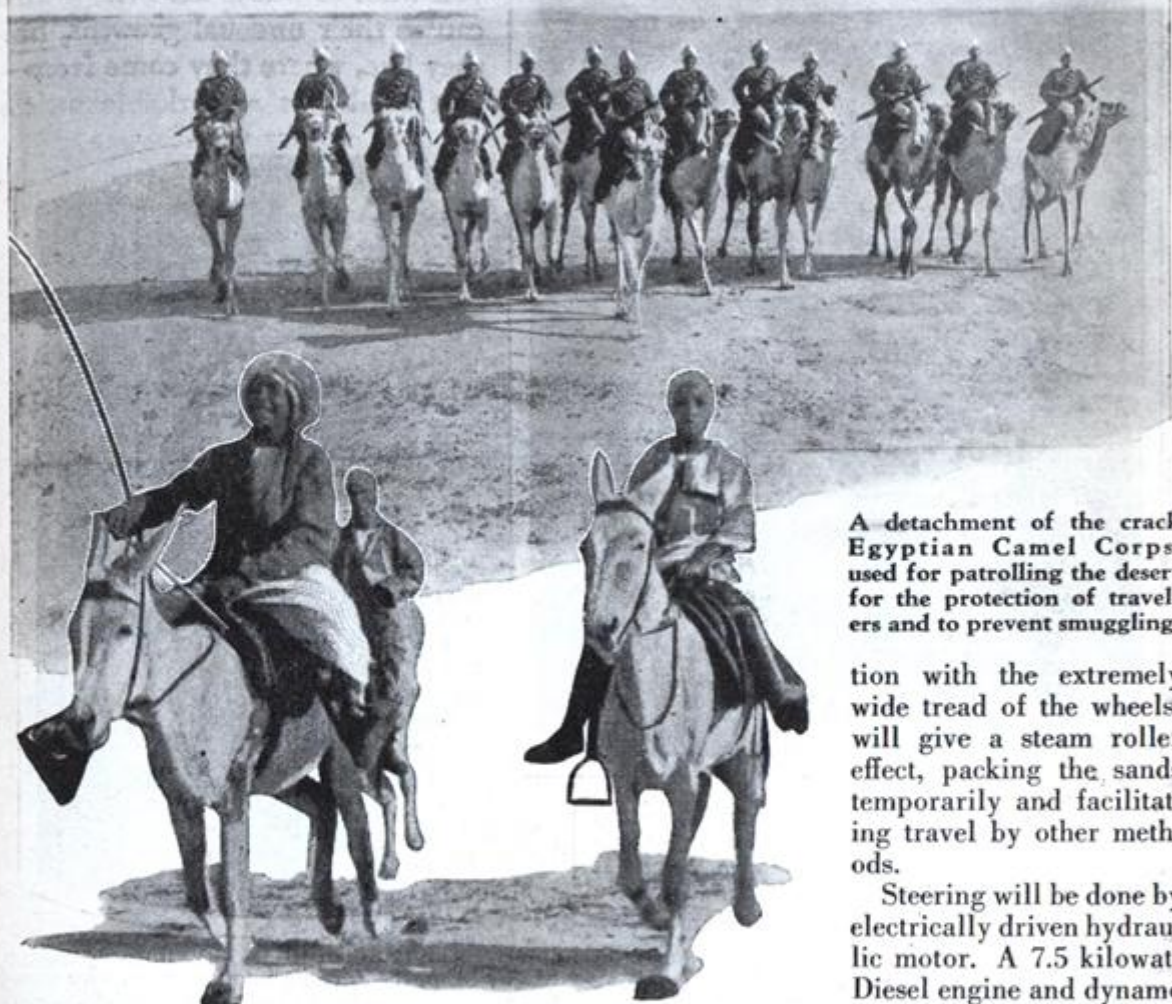
These plans call for a monster motor vehicle which is intended to serve as an alternative to railways in undeveloped countries and to supersede the present methods of desert transport, heretofore almost monopolized by the camel. This gigantic ship of the desert will be 86 feet long, 25 feet high, and will be propelled by Maybach engines developing 900 horsepower. Three decks will accommodate fifty-six passengers and more than twenty tons of freight, al-

This method of transportation over the desert is more comfortable than the camel but it has its definite limits.

though for short distances more than one hundred third-class passengers may be carried.

The long distance range of this "super-bus" will be more than six thousand miles at a speed of about thirty miles an hour,

to Replace CARAVANS



The jackass is still used on the borders of the desert by the poorer class of natives, but it is slow, and its range of operation is limited.

although on short distance hauls with heavier loads the speed will probably be about half that.

To enable it to traverse the large dunes found on the desert, the entire body of the desert ship will be suspended in a cradle from hydraulic springs on the axles of the wheels, which are to be fifteen feet in diameter.

The ship will build its own roads as it traverses the shifting sands of the trackless Sahara, for the enormous weight, in conjunc-

A detachment of the crack Egyptian Camel Corps, used for patrolling the desert for the protection of travelers and to prevent smuggling.

tion with the extremely wide tread of the wheels, will give a steam roller effect, packing the sands temporarily and facilitating travel by other methods.

Steering will be done by electrically driven hydraulic motor. A 7.5 kilowatt Diesel engine and dynamo will furnish the current for steering, lighting, and all other auxiliary purposes.

A powerful sending and receiving set will keep the vehicle in touch with the world, and will receive weather reports much the same as a ship at sea. Officers of the ship will also be skilled navigators, for over many stretches of the Sahara trails are obliterated by the shifting sands almost as fast as they are made.

Quarters for the first class passengers will rival those of the finest Pullman cars, and will be artificially cooled to combat the sun's rays,

A LAMBERT
PUBLICATION

50 CENTS
25 CENTS

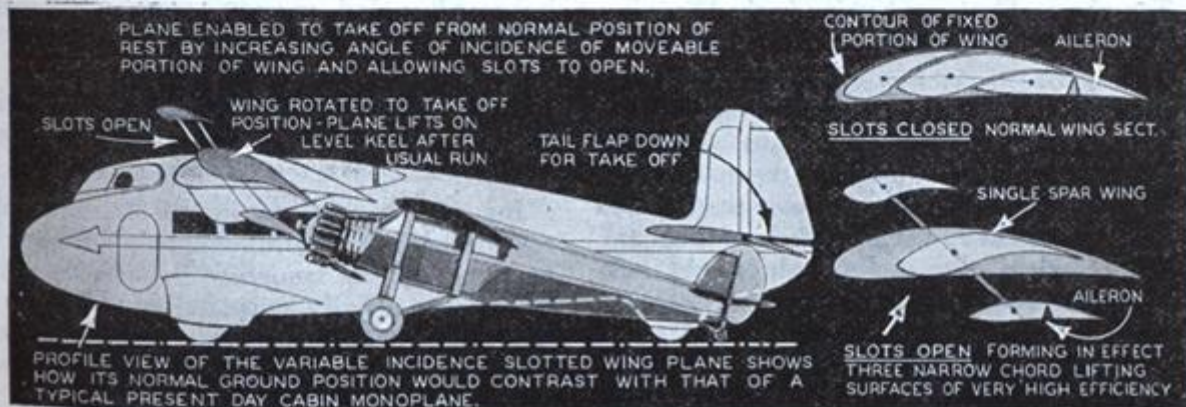
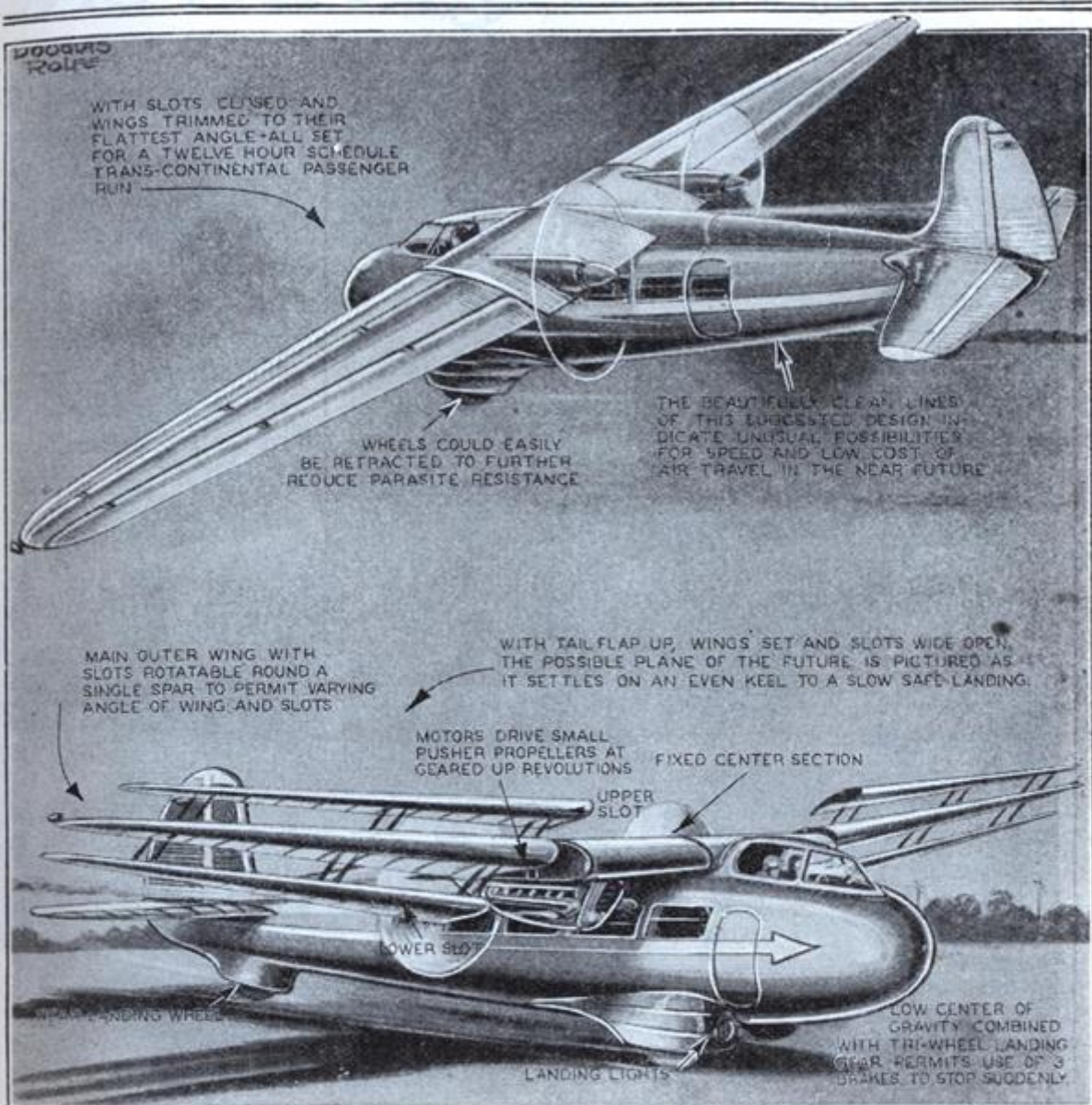
MODERN MECHANICS AND INVENTIONS

A NEW SHIP
OF THE DESERT
SEE PAGE 36

A large green ship with red wheels is shown on a desert landscape. The ship has multiple decks with windows and a tall mast. It is tilted slightly to the right. In the foreground, there are some small figures of people and a camel. The background is a vast, flat desert under a clear sky.

PROVE THE
EARTH IS
ROUND
AND WIN
\$5,000.00!

Single Spar Slotted Wings Next



This drawing represents a well known English aeronautical engineer's idea of what form the future passenger plane should take. The variable camber wing is not yet possible for engineering reasons.

I WAS A SLAVE-SCIENTIST IN RUSSIA

MI
special
features

EXCLUSIVE! *An eye-witness report on the fate of German scientists enslaved behind the Iron Curtain.*

By Dr. Otto Maar

"We are told to lie on the floor and a canvas is thrown over us."

Illustrated by Gurney Miller

FOR six months we have been imprisoned in the Bautzen detention camp—the first six months of a 25-year sentence to which we were condemned by a Soviet Military Court for supposed espionage and “anti-Soviet propaganda.” We squat all day on our bunks, because the cell is so small that we cannot move around in it.

One begins to run out of conversation after half a year and the only break comes at meal-





"A heavy key is turned in the lock—before the cell door is open we are wide awake."

times. It is an advantage to have studied physics and mathematics; you find many problems to ponder and in the seclusion of a cell it is easier to think out many of these than when free. But it is tiresome to solve differential equations in your head. A kingdom for a scrap of paper and a pencil!

It is two o'clock in the morning; although the cell is brightly lighted we are fast asleep. Suddenly a heavy key is turned in the lock, a noise that electrifies us. Before the cell door is opened we are wide awake and alert. We have had experience and we know that a visit from the Russian guard, especially at such an unusual hour, bodes no good. If something in our cell displeases him, we may all land in solitary. If he is making his customary search, we may lose valuable bits of our pitiful possessions. A multitude of unpleasant possibilities await us when the key turns in the lock.

The guard appears in the doorway and calls my name; as I answer he merely says, "Dress! Come along!" I roll out my bunk, jump into my uniform and walk out of the cell. My heart is beating in my throat and my whole body trembles.

On the way we are met by a guard

and another prisoner, obviously on his way back to the cell. As the two come near us, I cough and whisper in front of me, "What is it?" "Scientists," says the other. This little talk costs me a kick and a curse in Russian. But I am briefed on the picture. They are taking specialists for some work project. If you remain in Germany, very nice. But if you end up in Russia. . .

In a comfortless basement room sits a Russian in civilian clothes. In a toneless voice and in good German, he asks me to sit down. He takes up a folder, on the cover of which my name appears in Russian, and he turns the pages. After a while he asks me about my profession and my experience up to now. I don't know how to answer. I try to discover what he knows about me. I describe my education and I throw in a little lie or two to see how far I can go. The examination continues: "What did you do during the war?"

I do not like this question because I had worked on the development of an acoustic torpedo and later was technical advisor for acoustic-guided missiles. Naturally I don't want to let that out here. So I answer, "I trained technical assistants." The man sneers: "Were you so engaged for the whole war?" Natu-

"As they come near us I cough and whisper 'What is it?' 'Scientist,' says the other."





DR. OTTO MAAR, author of this report on the Russian prison camp at Kutschino, studied electrical engineering and physics at the universities of Darmstadt and Jena. He began his professional career in the electro-acoustics lab of a Berlin

firm. During World War II he worked in the German Navy Department on the development of an acoustically guided torpedo and in the Navy High Command as a technical advisor.

After the collapse of Germany he became a school teacher in a small town in Thuringen, a province in East Germany. He entered politics, was elected to the Thuringen Assembly. His attacks on compulsory socialization earned him the hatred of the Reds who arrested him on trumped-up charges. He was sentenced by a Soviet Military Tribunal to 25 years compulsory labor for "espionage and anti-Soviet propaganda." This article and the sequel in the October MI are reprinted from the German magazine *Der Monat*.

rally I cannot make that seem credible. "I took acoustical measurements in the Baltic. We had to do research on the transmission characteristics of sea water." He raises his finger to show me that this answer pleases him better.

It is clear that he knows something about me. I realize that the acoustic-

"In a toneless voice and in good German he asks me to sit down, takes up a folder—"

controlled torpedo is known to the Reds and I determine to speak as much as possible about things that are already known, saying nothing of things about which they are ignorant. So I describe how, in Danzig Bay, we tested torpedoes which automatically run in the direction of the sounds of ships. In our experi-

"We go in chains through Brest-Litowsk, accompanied by heavily armed Red guards."





"—standing around, gazing at us, full of curiosity; our arrival is obviously a welcome break."

"A valuable planing machine, upside down in the mud. It belongs to everyone, so nobody cares—"



ments we had been unable to follow the path of an electric torpedo at a depth of 12 meters, so we had equipped it with reflectors and launched it by night. Then the light spots on the water enabled us to follow its course. At launching tests with predetermined convoy lines this torpedo rushed underneath the target ships, darting from one to the other; I was so busy measuring the sound range of the ships that I could not pay any attention to anything else that went on.

Again I inject a couple of lies: "I was present at a number of test launchings but I never saw the inside of a torpedo." That is a smooth lie; my listener accepts it. He slaps the folder shut, rings for the guard and I am taken back to my cell. The next victim is brought in.

Weeks go by and I think less and less frequently of my night examination. Either the whole thing has been dropped or else I am of so little interest to the Soviets that they have given me up. It is now December and our thoughts turn to the outer world where Christmas preparations are beginning. The relatives of the countless prisoners will tearfully endeavor to prepare some Christmas cheer for their children. How many more Christmases like this are there to be? In Bautzen alone there are 6,000 prisoners and all are condemned to 25 years. We know that Bautzen is not the only disciplinary camp and we also know that many more prisoners are in the Soviet Union, living under more hopeless conditions behind barbed wire.

Then one day the key again turns in the lock. Again my name is called and this time it is "Pack everything together. Hurry! Hurry!" Again my heart starts beating in my throat. While I pack in great haste, there are parting words with my cellmates. "You know my address. I have yours in my head. If you have the chance to get news to my family, remember that perhaps I will go to Russia. Good luck." The cell door clangs shut. I stand with the guard alone in the hall. The journey has begun.

On The Way East

In the room into which I am taken there are about 20 prisoners with their

bundles. We discover we are all scientists and technicians. Each of us receives a piece of bread and a spoonful of marmalade. We swallow the marmalade quickly and put the bread in our bundles. We are handcuffed, then loaded on an open truck and told to lie on the floor. A canvas is thrown over us. At the last moment armed guards with dogs climb on the truck. So we travel through the streets of Bautzen.

Our prison wagon is coupled to a passenger train to Berlin. The truck is unheated and we freeze; it is December 14, 1949. In Oberschonhausen we are taken into a prison overnight.

Next day we go back to our truck. After many hours we are coupled to a freight train and start away; our train rolls on and on. Suddenly there is a halt. A train goes by us, stops in the station and the loudspeaker announces: "Frankfurt." As we start off again we know from the noises of the train that we are passing over the Oder Bridge. No one says a word. Our homeland is behind us. Before us lie 25 years of imprisonment in a foreign land.

We go in chains through Brest-Litowski, accompanied by heavily armed Red guards with dogs. Far ahead there are a few guards who make the crowds stand with their backs to the streets so that no one can see us. We are marched into a prison that surpasses in horror everything we have as yet run into. No artist could ever imagine anything more gruesome than this cheerless, windowless building. We are all locked together in one cell and notice that we have acquired some additions from Sachsenhausen. Now we are 34 men—engineers, mechanics and two glass blowers.

Our morale has sunk lower since we crossed the Russian frontier. Only young Horst L. from Sachsenhausen is optimistic and unaffected by the hopelessness of our situation. While talking with him I learn that he is an excellent high-frequency expert. He has some tobacco and a newspaper, a gift from Russian officers whose radio apparatus he had repaired in camp. For the first time in a year we smoked again. Although it is only Machorka we enjoy it and our morale improves at once.

[Continued on page 198]



"The chiefs are enraptured with my device; they take turns playing with it several times a day."

"The library has all the standard German works, important books from England, France, America—"



Slave Scientists

[Continued from page 63]

I also like George N. from Er. He is the oldest of us and gives an impression of calm. He tells us how he had offered to develop an ultrasonic apparatus for fighting cancer for the Russians. His plans interest me and I tell him I am an ultrasonic expert. "Then you are certainly assigned to the project," he says and I realize that my words at the examination at Bautzen have sealed my fate.

"How long in your opinion do we need to finish it?" I ask George N. I am no doctor but from my professional experiences I know that ultrasonic medicine is still in its infancy and there is nothing certain as to what will come from it. At least it is clear to me that the cancer project is a difficult and extensive task. George, on the contrary, calculates that we will finish it in two years. As I express doubts, he refers to his horoscope which forecasts a two-year stay in a foreign country and then freedom. From this moment onward I cannot believe that he is a scientist.

At The End Of The Journey

We spend three weeks on the journey, experiencing all the joys of such transportation. But finally we arrive at Kutschino, a veritable land of sunshine compared with what we had experienced so far. Kutschino is an outer suburb on the eastern border of Moscow, surrounded by forests and very little built up. There is a suburban railway station there and the trains run directly past our camp.

The first thing that strikes us is the courtesy of the guards. The search of our possessions is a mere formality here; the guard merely puts his hands in our bundles and rummages around a little.

Then we are taken to our lodgings. There are no cells but actual rooms; the doors are not locked and we can circulate freely. In the corridors there are prisoners standing around and gazing at us, full of curiosity; our arrival is obviously a welcome break for them. From some rooms comes the sound of music and singing. There are real beds here, a luxury we can hardly believe. The prison houses about 500 prisoners, mostly Russians but also Letts, Estonians

and Poles. We are so worn out with Bautzen and the journey that we make a pitiable impression. So they come to us from all sides and bring white bread, butter, sausage, sugar and cigarettes. Many speak English, others German and so we manage to understand each other.

From our German comrades we learn that Kutschino is a model camp in which only scientists and technical men are housed. But we learn also that one can very quickly find oneself back in one of the ordinary camps. The fact that we are in the Soviet Union weighs on our spirit a little but for the time being, at least, it is only Moscow and not Siberia.

Next morning, when the other prisoners go off to work, they tell us to stay in the prison; someone will fetch us. For half the morning we loaf around; we eat, smoke and shave with borrowed kits. Finally a guard comes and takes us to the Chief Engineer, Colonel Dobroschanski. When my turn comes he asks me very politely how I am. I tell him that he could not expect me to be well, that I have been through a trial and have come from a prison where the bread basket hung extremely high. The interpreter informs me that we shall have time to recuperate. Have I any wishes? My first concern is to write home. But no luck.

"You will not see your home again, reconcile yourself to that. You are only burdening yourself unnecessarily. Why do you want to write? You cannot do anything else except work well here; that is the only possible way to improve your situation. Furthermore, you will not find things bad here."

These are the words with which the Chief Engineer prepares me for the future. I ask him whether he believes that under such conditions one can work scientifically. Condemned to such a fate, life would have no further meaning. Then, what incentive would one have?

"You have still 25 years to get through," he answers, "and when that time is past you will have neither the desire nor ability to return to Germany." His tone is compassionate, almost paternal. "I cannot help

[Continued on page 202]

Slave Scientists

[Continued from page 198]

you. You are being punished and I have nothing to do with that; I cannot change Soviet laws. No one wants to change them. I can only warn you. If you do not work well here you will pass your 25 years in Workuta. And believe me, you are better off here."

Other interviews run along the same lines. When we are all through, the guard leads us to the yard. A valuable planing machine is upside down in the mud and we are to get it out. It must have been there a long time as the mud is now frozen and the heavy machine is embedded in it as firmly as if covered with concrete.

While the cross-pickaxes are being fetched, I go over to Karl H., a prominent Communist prisoner. I say to him, "See, this machine belongs to everyone who passes by, that is why no one cares about it. If it had been paid for out of some individual pocket, it would not be lying here."

It is astounding, all the stuff that is lying around this yard and being ruined. Film projection apparatus, telephones, refrigerators and so forth.

In The Laboratories

After a few days we are assigned to workshops. Here are all kinds of laboratories, small and large production shops and a very well-kept library. In the laboratories quartzes are cut, as they are used for stabilizing frequencies; projectors (reflectors) are made; synthetics, ceramics, and insulation materials are developed. A whole section works on apparatus for so-called "border protection." In the production shops telescopic receivers and magnet phones are built. Everything possible is experimented with here but there is no uniform organization.

The whole camp is barely one kilometer long and about 500 meters wide. Around it runs a wall, and five meters away from it is a low barbed wire fence. At certain places along the wall are observation towers. Not only prisoners work here but also many "free" persons, including women and girls. Most of them live in Moscow and come to work on the suburban train.



solves woodworking problems in seconds!

Speed your jobs, get answers to countless building and woodworking questions immediately! Improved GREENLEE Woodworking Calculator converts linear to board feet, gives nail specifications, tool sharpening tips. Compares woods, gives bit sizes for screws, concrete mixes, painting information, etc. Convenient . . . simple to read. 6" diameter . . . heavily varnished cardboard. Special offer by the makers of famous GREENLEE tools . . . **Only 25c**

(no stamps please)



I go to work in two laboratories concurrently. One is a medical laboratory apparently only just opened, as there is practically nothing there except the rooms and furniture. The top man of the section is the prisoner George N. who promises the blue skies above and is laden with grand new plans. His ultrasonic cancer project has been forgotten. Now George has another big idea—encephalography. He will detect the minute electromagnetic impulses of the brain and make them visible on a screen. Something like that was done in Germany and George has doubtless read about it.

Mayronowski, the Russian Colonel in charge of the section, is all fire and flame; he believes that with such a device thoughts could be read. George encourages this belief. I try to caution George to be careful but he does not want to hear any warnings.

We are a wonderful group, understand each other splendidly and we have a Chief who cannot check us. Horst L., the high-frequency expert, begins to build a huge amplifier; that is all he has undertaken to do so nothing can happen to him. I begin to design ultrasonic transmitters of various frequencies and powers. The scope of their tasks is clearly outlined for Werner and Gunter. We are all assured for the time being. Only George keeps us anxious; he is maneuvering himself into a fatal position. He thrusts our warnings aside. "Leave me alone, I shall get along beautifully." He cannot be shown, we can't shake his faith in his horoscope.

In the forenoon I work in the boundary "line-projector" section where devices are developed for guarding Soviet frontiers. It consists of three laboratories. The Chief is Major Schdanow, who regards prisoners as the scum of humanity, is basically suspicious and is one of the most dreaded officers in the camp. The technical brains of the section is Major Arapoff, a prominent authority, very polite when contact with the prisoners is limited to technical questions. The chief of my laboratory is Major Malutin, a good-humored moron who has a little technical knowledge and tries on the whole to live on good terms with the prisoners.

After a few days I get an individual interpreter, a splendid fellow. His name is



BEFORE—just an ordinary unfinished basement.



AFTER—see what a difference Weldwood makes! Weldwood Novoply® walls add a textured look that turns basement into beautiful, practical children's playroom. Large panels make it easy to plan, easy to do.

New do-it-yourself book by Weldwood shows you

how to wood panel a wall • how to make a plastic laminate sink top • how to saw and work plywood • how to finish plywood • what to do about a "problem" basement • how to glue plywood and has all kinds of tips for the home craftsman. Plus dozens of pictures of finished projects!

SEND FOR THIS BIG 40-PAGE BOOK TODAY! And see your lumber dealer for beautiful Weldwood Hardwood Plywoods and superior Weldwood Douglas Fir Plywood or, to see the complete line, visit any of the 87 United States Plywood showrooms in principal cities.

Weldwood® **HARDWOOD PLYWOOD**

Made by the World's Largest Plywood Organization

United States Plywood Corporation
Box 61, New York 46, New York

MI-9-5

Enclosed is 25¢ for your new "Weldwood Do-It-Yourself" book. Please rush my copy!

Name

Address

City State

Aljoscha and he is serving a 15-year sentence; he has been a major in the Red army. His first words are: "Don't trust anyone here—not even your best friend. The only one you can trust here is your mother."

My first job in the boundary "line-protector" section is a mirror-testing device with which parabolic hollow mirrors in production can be tested by unskilled personnel. For a few days I juggle with a small case, an indicator, a little red lamp and a bell. The mirror to be tested is placed on the case and a crank is turned until a short bell tone is heard. If the mirror has no defect, nothing more happens; otherwise the indicator moves and a little red lamp lights up. The chiefs are enraptured; they take turns playing with it several times a day.

The device needs some improvements; it is at the stage of a good laboratory sample but is still too unhandy for practical use. I tell the chief this but he doesn't understand me at all. He says that it is too late for changes and improvements as the apparatus is already sold. I protest that a

reputable firm would not sell it. Malutin shakes with laughter, slaps me on the shoulder and tells me that I apparently want to get a prize. A young lieutenant takes the apparatus to its testing place and returns two days later. The factory has found a production fault in it. The acting Minister has said he would like to see the builder of the apparatus but changed his mind when he heard that I was a prisoner.

In the medical lab it is so comfortable that we volunteer for evening work. Each of us has his own table and a desk lamp and no one disturbs us. Gunter can draw very well and he finishes a pack of cards. He is in love with Nina, a young laboratory worker who is supposed to superintend us on these evenings, and as she is not unresponsive she pays no attention to our activities.

Meanwhile I obtain permission to use the library. It is unusually well arranged. Hardly one of the German standard works in physics, mathematics and technology is missing. Many books have the names of former German owners; among them are acquaintances and high school companions

More Wham-More Fun
and new Remington "Rocket"
22 shorts with Q-99 are
double-duty ammunition!



You'll hear the extra speed in their sharper "crack." With muzzle velocity 40% faster than sound, Remington "Rocket" 22's are like no other 22's you've ever known!

Their special 15-grain composition-bullets are made with Q-99, an exclusive Remington ingredient that gives solid strength for small game and plinking... yet permits easy breakup on steel backstops! No other 22's have this double-duty feature. Easy-scoring, too—a special shoulder punches cleaner holes in paper targets.

Remington "Rockets" have strong brass cases, exclusive "Kleanbore" priming (no gun cleaning needed!) and come in handy flat-packs that fit your pocket. Try new Remington "Rocket" 22's today!



Remington 

"Rocket," "Kleanbore" are Reg. U. S. Pat. Off. by Remington Arms Company, Inc., Bridgeport 2, Conn.
"If It's Remington — It's Right!"

of mine. In the Russian language I discover Robert Pohl's volumes on experimental physics. I recognize the illustrations and formulas; it seems to be a verbatim translation under the name of a Russian author. An unabashed plagiarism but in time I shall grow used to that.

All the more important science periodicals and books from England, America, France, Italy and Switzerland are here. I learn from the American periodicals how synthetic quartz is manufactured, I find precise descriptions of the newest types of aircraft, detailed articles on military problems, rocket technology, and armored combat arms, and I am surprised at the public manner in which Americans appraise everything. The high point of my discoveries is the 26-volume work of the Massachusetts Institute of Technology in which the development of radar during World War II is described. I had been introduced during the war to the development of this enormously important technique but I had never been able to obtain any deep insight into this field. For that I had to come to Moscow! •

(Editor's Note: In the second part of Dr. Maar's remarkable account of his imprisonment in Russia, to be published in the October issue of MI, he describes the Top Secret "border protection" device he is forced to develop for the Soviets . . . numerous suicides amongst the enslaved German scientists . . . how the prisoners outwit their Red captors . . . the state of scientific research at Kutschino . . . how Russian engineers cover up their mistakes . . . his transfer to the dreaded prison camp at Workuta and his eventual return to Germany.)

Is Your City A Fire Trap?

[Continued from page 87]

protection. Unhappily, big fires are still a menace.

Only a year ago Mr. Neale reported to the Society of Fire Protection Engineers that large-loss blazes—those that destroy property worth \$250,000 or more—are a cause of growing concern. About 300 such blazes occur each year. Now this figure represents only a small fraction of one per

[Continued on page 208]

CHAN NEL LOCK pliers
The most versatile
tools on your bench



insist on...

CHAN NEL LOCK

TRADE MARK REG

U. S. PATENT OFFICE



here's why

Look for the Channellock line when you're shopping for hand tools. Channellock pliers offer features that you can't get with other makes. And when you buy a Channellock plier, ask to see the full line—you'll find a style and model to do any job better.



CHAN NEL LOCK

TRADE MARK REG U. S. PATENT OFFICE

THE PLIER DESIGN THAT OBSOLETE ALL OTHERS

CHAMPION D^oARMENT TOOL CO. • MEADVILLE, PA.

I WAS A SLAVE-SCIENTIST IN RUSSIA

PART TWO

Suicide or Siberia seemed the only ways out for the "captive brains" in the secret research camp.

By Dr. Otto Maar



(Note: In the first part of this report (September MI) by a German scientist imprisoned in Russia and forced to do research for the Reds, Dr. Maar tells how he was arrested in the East Zone of Germany and sentenced to 25 years imprisonment for "espionage" and "anti-

"Blood streams from his heart, the pistol falls from his hand."

ART BY GURNEY MILLER



"'By this silence you show you are still our enemy!' I am relieved when he calms down again."

Soviet propaganda." With other German scientists and technicians he makes a long, harrowing journey to the Russian prison camp at Kutschino, in the environs of Moscow. Here he works on "border protection devices" for the Reds and learn first-hand of their slip-

shod production methods and the ignorance of some of their scientists. Conditions at Kutschino are relatively mild. But over the prisoners hangs the threat of Workuta—a dreaded prison camp in Siberia. Now continue Dr. Maar's remarkable story . . .)



THE way to the prison library is along a huge balcony. One day I hear a shot and rush to the door as Anatol, a Russian prisoner, collapses against the balcony. Blood is streaming from his heart, the pistol drops from his hand. It is a primitive weapon he has made himself; the explosive is from the lab. I take my coat off, roll it up and place it under his head. Then I run to the Chief Engineer whose office is close by. Meanwhile a few people have already gathered around. Dobroschanski only shakes his head. A secretary chatters away uninterruptedly and giggles.

"They are trying it out on dogs; every day one hears their tortured howling."

Two men fetch a stretcher and take Anatol to an infirmary, where he dies that evening. A few days later the chemist Aronow poisons himself. He drinks hydrochloric acid and dies after horrible agony. Suicides are not rare here; mostly they use poisons from the chemical laboratories.

But there are also happier experiences. Hans B. builds a magnetophone device. In his laboratory are tape recordings of the former National Broadcasting, Berlin. At his work he manages to install a loudspeaker in the window—for "testing." Then Wagner operas or the Unfinished Symphony reverberate through the yard. Sounds from another world!

In the evening we swap experiences, play chess or have news items translated from Pravda. Horst has very cozily built himself a short wave receiver. He listens regularly to the BBC broadcasts. When the weather is good we go out in the yard to play games. Anyone who wishes may go to the general room to watch TV. The Russians sit night after night before the screen; they roar with laughter at the programs.

One rainy Sunday afternoon I watch a soccer game between Dynamo and Spartak, top Soviet teams. I notice that the crowd is clearly on the side of Spartak; every little error on the part of Dynamo is wildly hissed. Aljoscha tells me that Dynamo is practically the secret police staff and on such occasions the people can air their feelings for once.

Meanwhile Major Schdanow has new plans for me. He wants to form a border protection group of which I am to be leader. He has at the moment no specific assignment; he is waiting for some good suggestions, something like the mirror-testing device. As I remain silent, he tries to help a little. He leans toward devices with which one can observe or catch men over the landscape. For example, in a neighboring laboratory an electric fence has been developed whose frequency and current are supposedly so adjusted that anyone who touches the fence remains stuck there, without being killed. At the moment they are trying it on dogs, and every day one hears the howling of the tortured animals.



"—Soldiers come and take George away, along with the contents of his files."

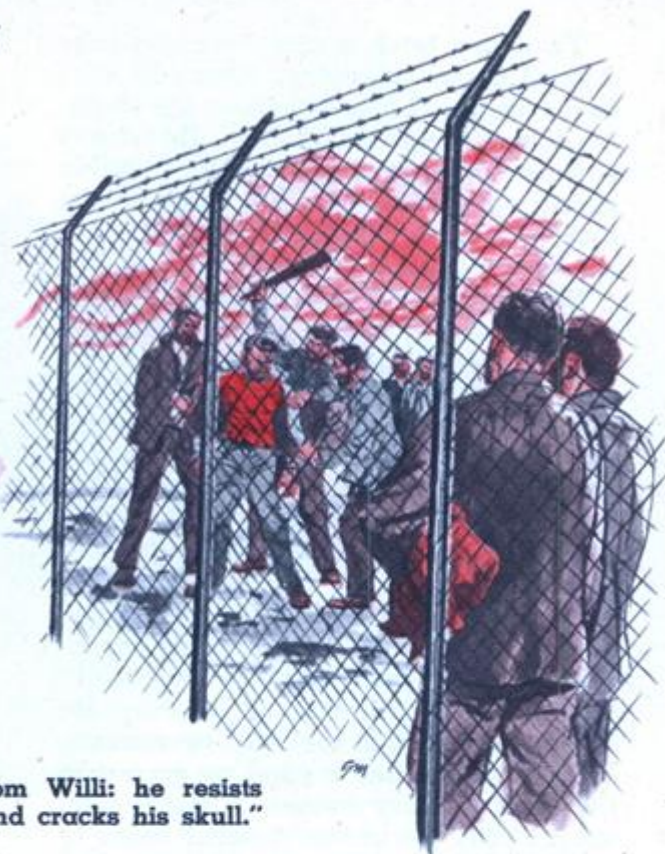
"While Mayronowski stands and marvels, Horst listens to the news from London."



"Great holes are dug in the yard; everything not needed at once is buried there."



"They try to steal from Willi: he resists and a blow from behind cracks his skull."



In the course of the conversation, Schdanow asks me whether photographs can be taken without lenses. I have never heard of it. He blares out that with the electron-microscope, photography is done without lenses. Schdanow's ignorance finally exhausts my patience. "If you want to take landscape photographs with it you would have to heat the trees so that they produce electrons." This convinces him that he can't make a big thing out of that.

After a few days the following plan is evolved: An ultra-red projector throws a concentrated ray on a photo element at a distance of one hundred meters. If a man runs through the ray there is a tone signal. In foreign literature there are numerous patterns for this and all we need do is build one according to the nearest pattern.

Always the same thing; always copying. Very rarely is any really independent research attempted. But the Soviets excel in their espionage set-up. Almost every day, here in Kutschino, microfilm comes in from all over the world. A staff of experts is engaged in appraising and recording the secret information. On the

other hand Soviet security is virtually impenetrable.

Malutin brings up a captured German Zeiss optical-phone device. It is based on the principle that the ray path is made by two prisms, of which one moves very delicately and in this way produces a modulation. When I suggest to Malutin that it is easy to copy, he answers that that is not possible here. I must find something simpler, even if it does not work so efficiently as the Zeiss device.

I distribute the assignments among the group and we make a simple model. The modulation is then produced by sending the lamp current through a chopper (vibrator) as is done in automobile radios. This cannot go very far, and the lamp is thermically much too slow to go out a hundred times a second. But at the moment we can do no better. I ask all the Chiefs to obtain a Kerr cell from the sound film industry, but that is quite impossible. Since we have a quartz laboratory in the camp, I decide to undertake ultrasonic modulation.

Meanwhile, the situation in the medical laboratory begins to come to a head. Mayronowski has nothing to show and



"When the guards come no one dares point out the murderer; we are all terrorized."

is being hounded by the control-commissioner who gives him the devil in front of us. One day soldiers come and take George away and take possession of the contents of all the desks.

During the mid-day break George is brought before the whole staff. An officer reads the sentence: The prisoner George N. has misrepresented himself as a specialist. On his suggestion experiments have been undertaken which led to no results. He has sabotaged the social structure and will be removed to a camp in the far north. We know of this camp; it is called Workuta. We are sorry about George because he was a good comrade.

A doctor takes George's place, and he seems to know more about his field. The encephalo- [Continued on page 217]

"We realize a long journey lies ahead; certain signs point toward Germany."



MODERN MECHANIX

November

& INVENTIONS MAGAZINE

NOW
15¢
IN CANADA 20¢



\$1,750
CONTEST

More than 100

CASH
PRIZES

See Page 42

Bernie Bierman's Football Secrets

Streamline BEAUTIES



ROLLING along railways of the world at greater than mile-a-minute speeds, streamlined trains are conquering time and space in an attempt to keep the traveling public from deserting the rails for airplanes and motor buses.

Three choices have been offered to the jury of travelers—the ordinary steam train running on faster schedules, the beautiful Diesel-powered streamliner, and the light weight steam streamliner in its gleaming new dress of chromium and brass. A fourth contestant recently entered the picture—a turbine-drive steam locomotive that may surpass all others in speed, safety, and comfort.

Making its first trials on British railways is the turbomotive, popularly called the "hush hush" giant because of the secrecy which cloaked development work on the engine. No exterior working parts, two funnels, a radiator, and a high efficiency steam turbine drive make this train a radical departure from ever-conservative British design.

In answer to the challenge, "Are steam locomotives doomed?" S. A. Kraft, a St. Paul, Minn., mechanical engineer, designed the super-turbine train pictured on the cover of this issue. With drive wheels nearly as high as the train itself carrying the entire weight of the engine, there is no weight resting on wheels that produce no power. Independent



Two beauties challenge the Iron Horse for supremacy on the Chicago-Twin Cities route. Over this speedway of America race each day the streamlined oil-burning steam train *Hiawatha* (top), the twin *Zephyr* Diesels, one of which is shown at the right, and *The 400*, conventional, but improved, steam locomotive. Time schedules are about the same for each. The V-16 Diesel engine (above) develops 1,200 horsepower for the Union Pacific's *City of Portland*.

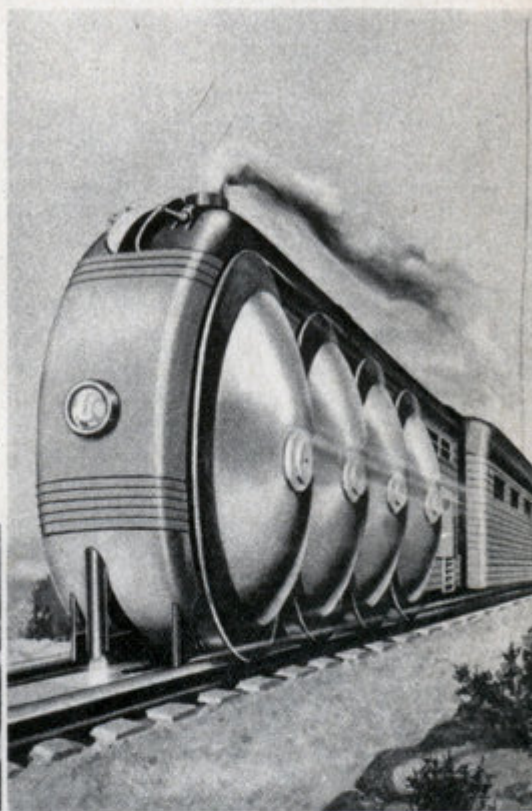


Lure TRAVELERS *to Rails*

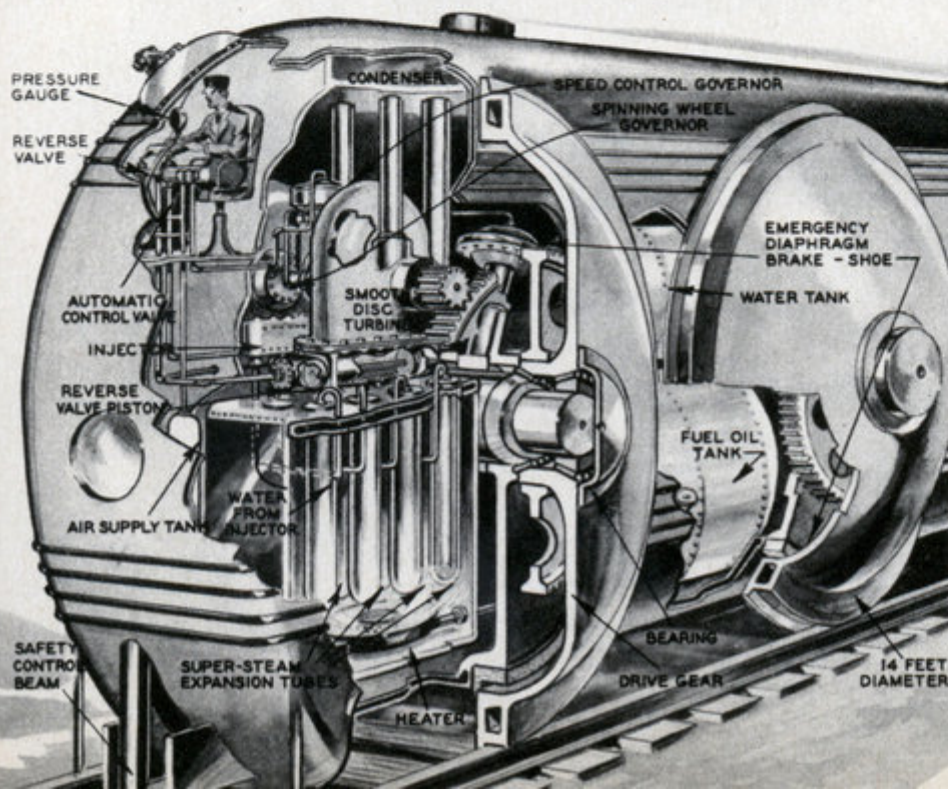
drive for each wheel eliminates any drag in rounding curves.

Geared to each of the wheels is a steam turbine having a perfectly smooth disc. Super-steam directed against this disc at terrific pressure exerts as much force as it would against vanes.

The roadbed itself is the only limit to the speed of this million-pound rail giant. Control is completely automatic, the engineer having only to set the single throttle to the desired speed. By a system of compressed air lines, valves are opened to admit steam to each turbine until the train reaches running speed, and brakes are



Shortly after British railways carried out first tests on the *turbomotive*, turbine-driven steam locomotive shown at left, S. A. Kraft, St. Paul, Minn., mechanical engineer, announced his design of the above super-turbine speed train.



The Kraft super-turbine train has no exterior moving parts except the wheels. The engineer, seated high above turbines, has only one control—that for speed. Sketched here is one four-wheel unit; as many of these as are necessary may be used together. Photo-cell equipment responds to signals painted on roadbed to slow or stop the train.

STREAMLINERS CHALLENGE THE "IRON HORSE"

applied automatically whenever this speed is exceeded on down grades. Should any wheel slip while maximum tractive effort is being applied in starting, steam will be cut off from that turbine momentarily to give the wheel a chance to grip the rails again.

No air brake lever would be needed, for the robot control system applies brakes just as soon as the train is travelling two miles faster than the speed at which the throttle is set.

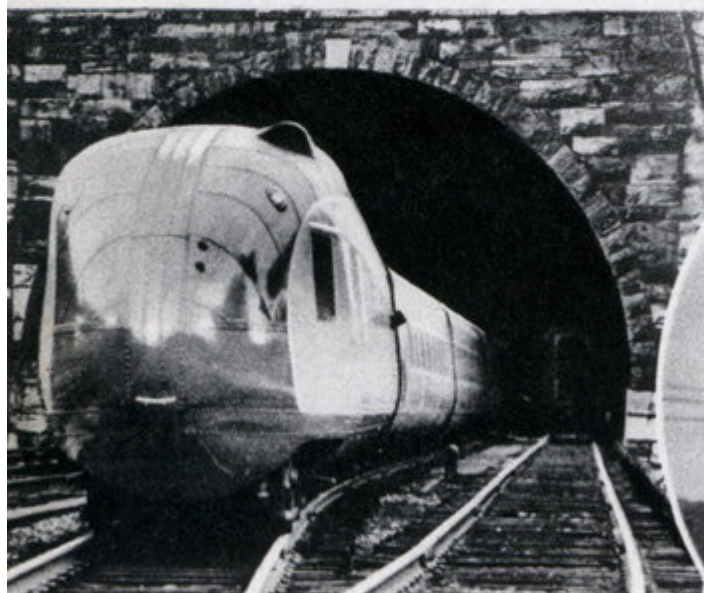
Best known of the new steam trains is *The 400*, for a time the fastest scheduled train in the country. Increased boiler pressure, larger drive wheels, use of oil fuel to eliminate coal-ing stops, and heavily-ballasted roadbeds made the greater speed possible.

In a merry-go-round of speed, Burlington's twin *Zephyrs*, popular Diesel-powered trains, are each making a round trip a day on the speedway of America, the route between the Twin Cities and Chicago.

But a scant year ago the first Union Pacific streamliner started the back-to-the-rails campaign. Rebuilt into a 7-car unit with a new 1,200 h.p. Winton Diesel power plant, this original *M-10001* has been rechristened *City of Portland*. Running on a 40-hour schedule between Chicago and Portland, it brings Chicagoans 12 hours closer to the West coast by rail.

North, East, South, or West—Diesel streamliners are whizzing over the rails.

Streamlined steam power is the answer of several roads to Diesel competition. The Milwaukee Road's *Hiawatha*, designed for two-mile a minute speed, races the *Zephyrs* and *The 400* daily on the Chicago-Twin Cities route. Other lightweight steam trains are the *Twentieth Century* and *Broadway Limited* in the United States, the *Flying Hamburger* and *Flying Frankfurter* in Germany, the *Asia*, in Southern Manchuria, and scores of other challengers in nearly every nation of the world.



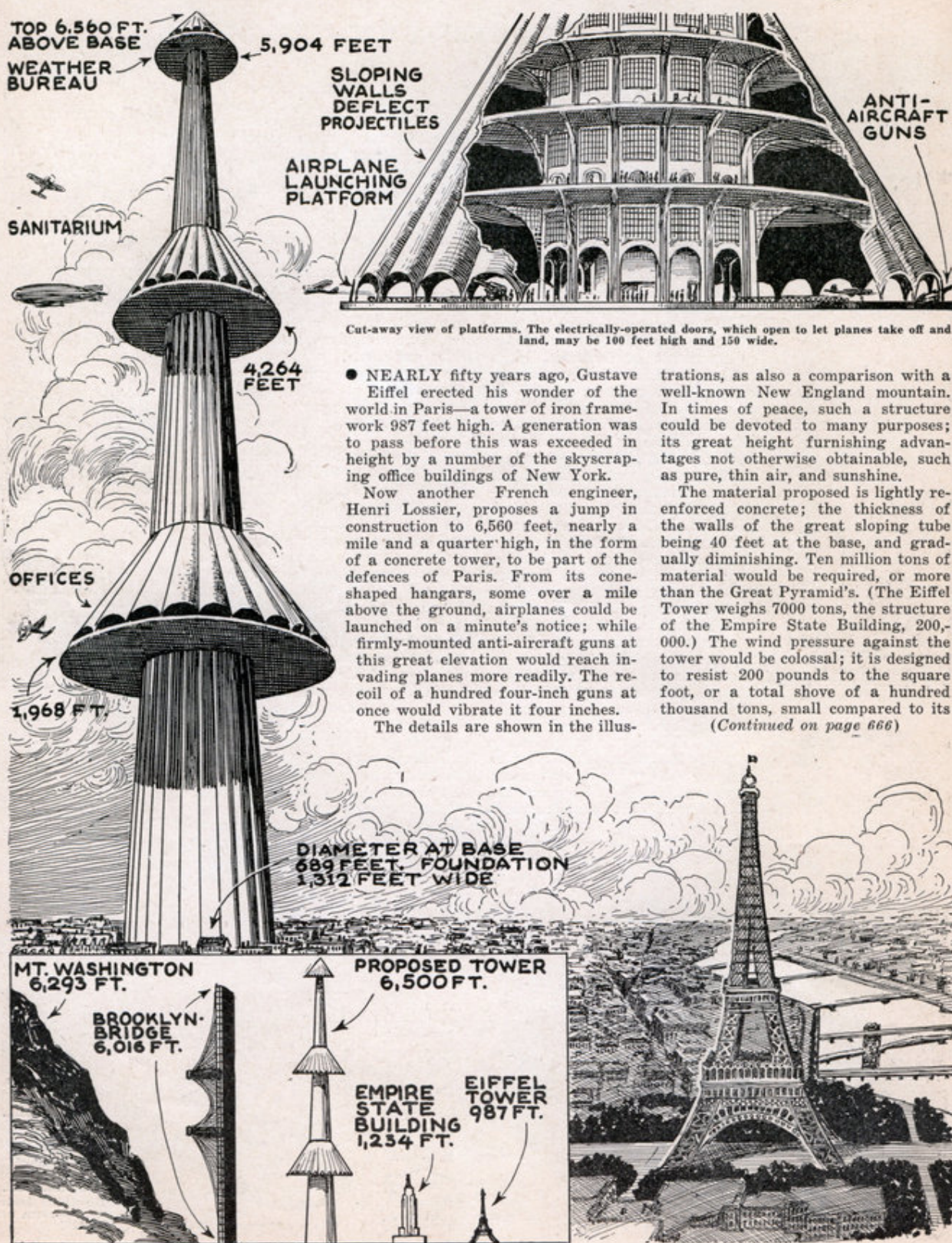
This is not a prehistoric caterpillar crawling out of its cave, but the tail-end of the new Union Pacific streamliner *City of Portland* entering a tunnel. On the 25 pfennig German stamp below is the famous *Flying Hamburger*, said to be the granddaddy of the streamliners. The 40 pfennig stamp shows a widely acclaimed German "super" streamline train.



Smoke and steam emphasize the streamline beauty of the *Commodore Vanderbilt*, New York Central's new streamlined steam train. Near a point on the Mississippi river (shown below) Burlington's twin *Zephyrs* pass twice daily.



Fort More Than Mile High?



Paris' proposed tower, compared with other structures of the world. The architect says a tower six miles high can be built if needed.

MODERN MECHANIX

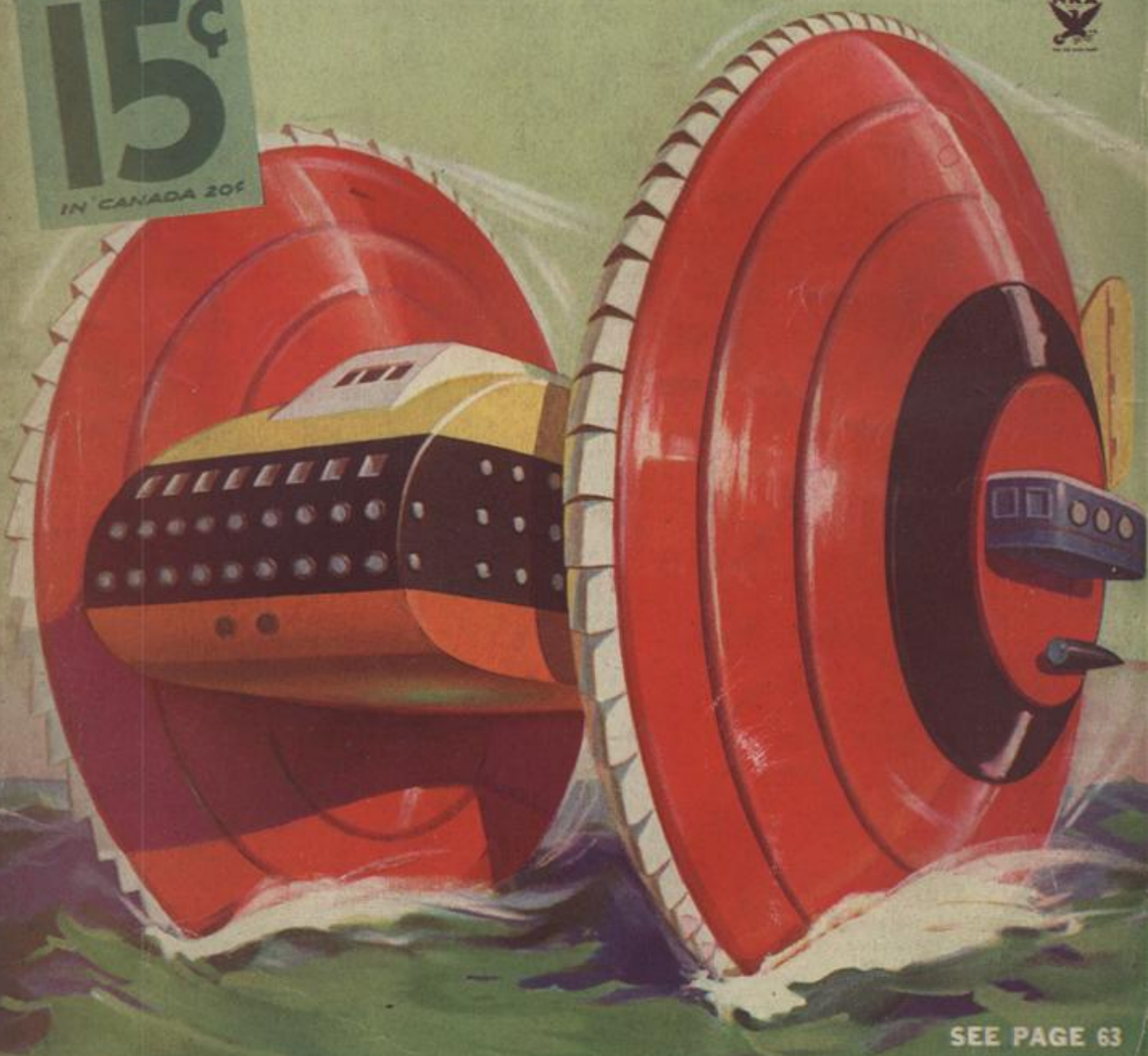
AND INVENTIONS

JUNE



NOW
15¢

IN CANADA 20¢



SEE PAGE 63

**INSIDE UNCLE SAM'S NEW GOLD VAULT
BURIED ALIVE WITH THE TUNNEL BUILDERS**

Turbo Wheel Liners to Speed Across Seas

AVIATION'S rapid strides are revolutionizing all other modes of transportation. Railroads are meeting the demand for greater speed with streamlined trains. Automobiles are following the most modern trends in streamlining.

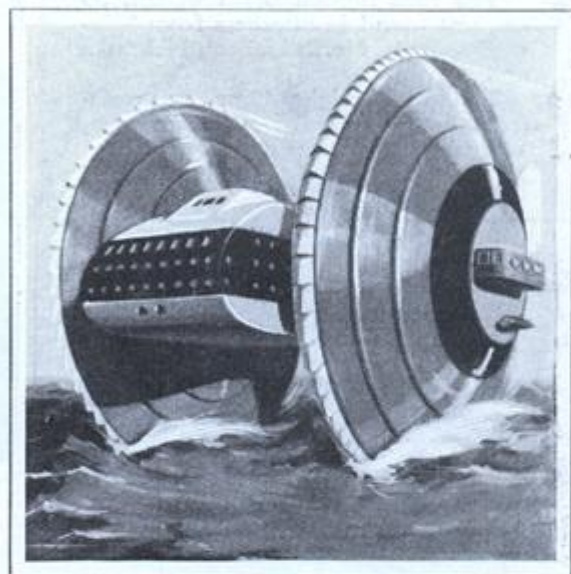
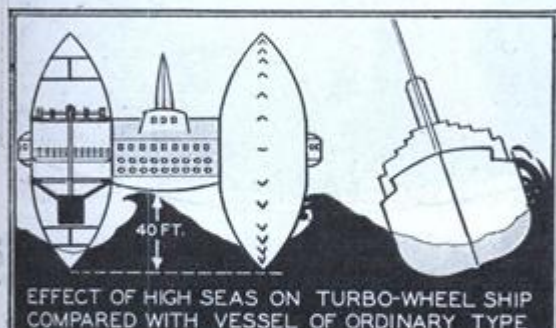
On the seas, however, even a streamlined ship will not be able to meet the competition of regular airplane schedules touching airports anchored in the ocean. Resistance from wind is great, but the sea itself slows down an ocean liner much more.

To overcome this an inventor has conceived the Turbo Wheel liner, which is expected to reach a speed of 100 miles an hour. At this speed the rapidly revolving wheels of the liner will lift the hull out of the water. The ship will ride on the outer rim of the wheels only.

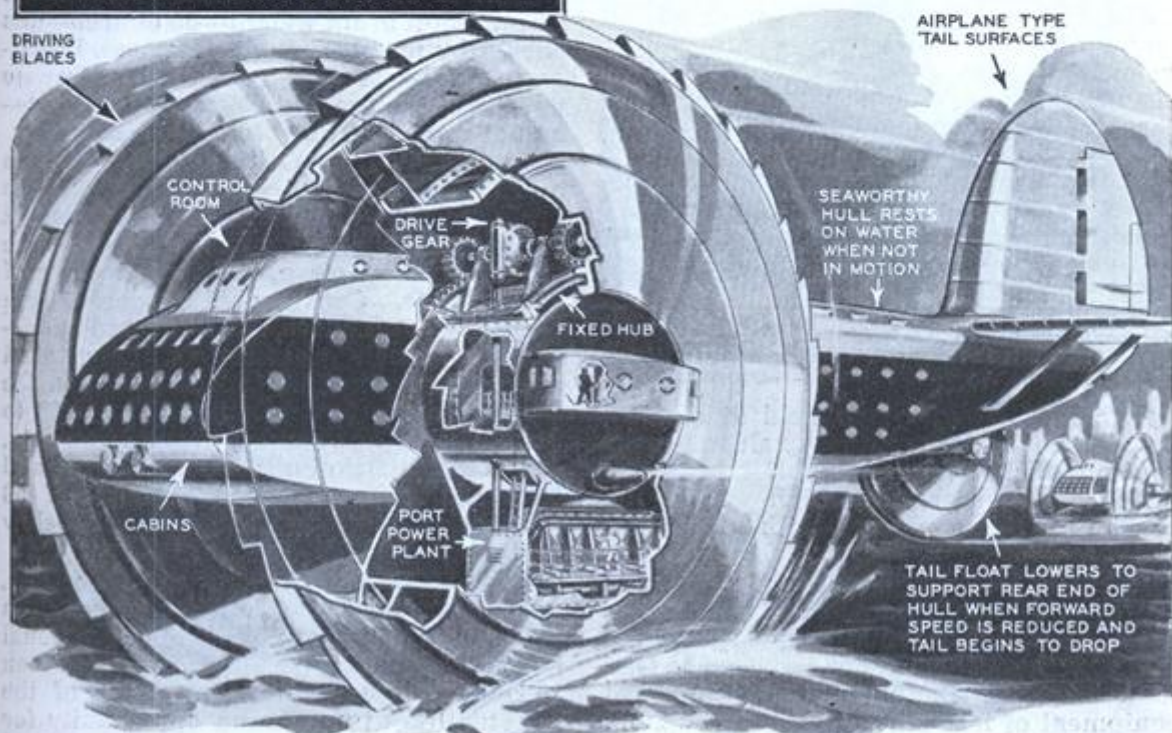
A lifting tail of airplane type holds the hull parallel to the line of travel. Normal

airplane rudder and tail flaps control steering at high speeds.

At low speeds a revolving tail float is lowered to support the rear end of the hull and provide steering. Powerful Diesel type engines slung low within the rotor wheels drive each wheel independently through gearing. The Turbo Liners are expected to be capable of a speed of 100 miles per hour.



This radical design for an ocean liner would revolutionize sea travel. The ship could travel 100 miles an hour.



Cutaway drawing above shows location of power plant and gear drive to revolve wheels. Huge fluted wheels propel the liner at 100 miles per hour. At rest the huge cabin hull would float on the ocean as shown in the right background.

Will the desperate men in the Kremlin attack?
By 1954 Russia will be strong enough to do so.
That is why our former Air Force chief states:

We Are in **PERIL!**

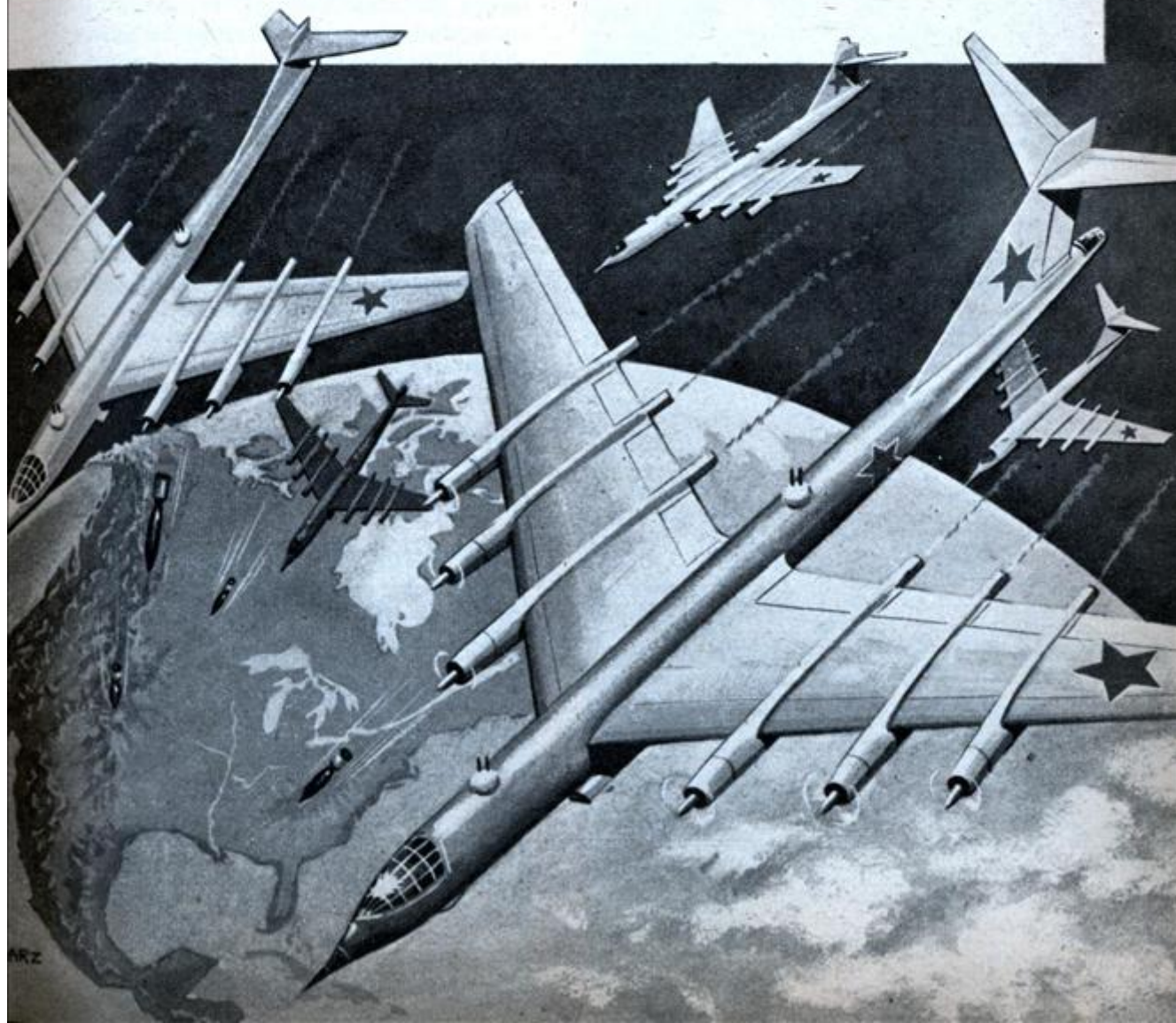


GEN. HOYT S. VANDENBERG

ON MARCH 6, 1953, I appeared before the Armed Forces Subcommittee of the Appropriations Committee of the House of Representatives. The purpose of my appearance there was to introduce the Air Force budget for the fiscal year 1954. The budget introduced at that time was designed

to continue the buildup toward the 143-wing air force goal which had been fixed by the Joint Chiefs of Staff, approved by the Department of Defense, and sanctioned by congressional action.

The statement I made before the House committee included a detailed review of





Most Russian aircraft like the TB-7 Torpedo Bomber above, are kept under close wraps. We have very little performance data on their ships except information they've "planted."

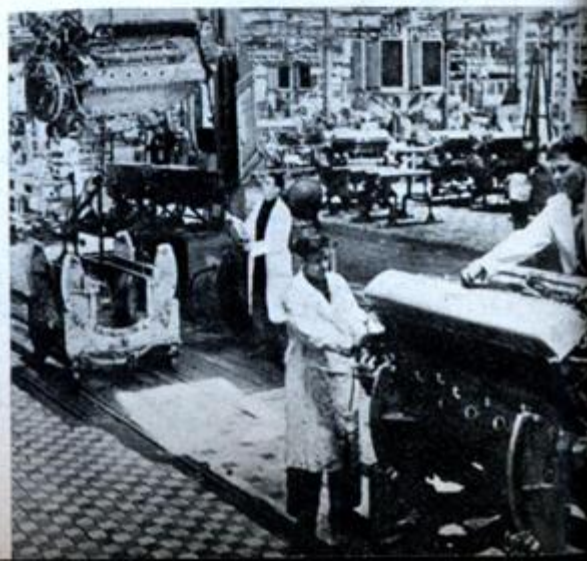
enemy and friendly air strength. It provided a background of information which served to explain why an air force of at least 143 wings is an essential component of our worldwide resistance to Communist power. It stated that an air force of no less than 143 wings is the minimum force which can assure the ability of this Nation to resist successfully an all-out Communist attack.

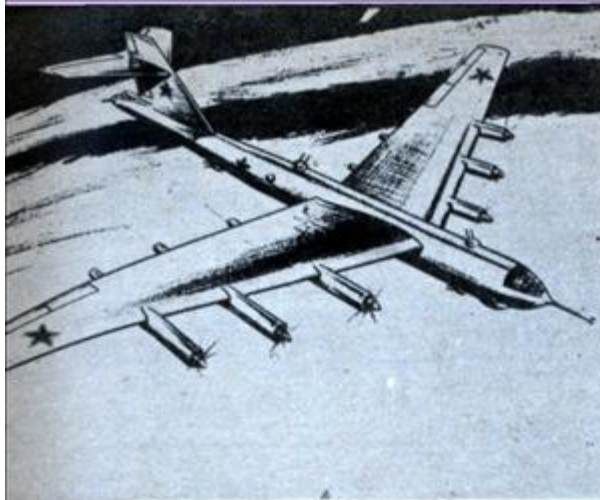
In that statement I also expressed the hope that continued and uninterrupted progress toward an air force of this size and strength would deter the Soviet rulers from launching such an all-out attack against us.

There was a detailed analysis of the tasks and missions charged to the Air Force and a careful evaluation of the forces which would oppose us in the event of a general war in 1954 or thereafter.

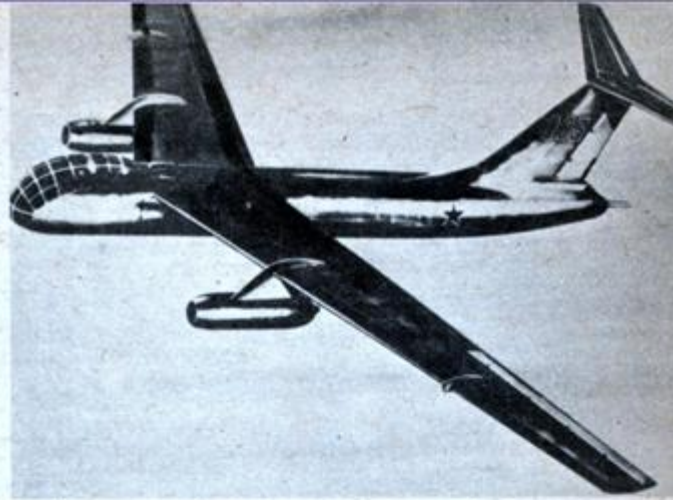
The year 1954, I repeat, is considered critical principally because of the estimate

Production technology is constantly being perfected in Soviet war plants. This is a modern Russian aircraft factory assembling bomber engines in production line fashion.





Information from behind the Iron Curtain is translated into artist's conceptions of Red aircraft. Plane above appears to have six turbo-prop engines; ceiling of 50,000 feet.



Designed for Russia by Germany's Junker design engineers, the Model 150 Russian jet is said to be in the 650 mph class, with 46,000 ft. ceiling, range about 2,250 miles.

that the Soviet Union will, by that time, have a stockpile of atomic weapons sufficient to mount a devastating attack on United States military installations, industry, and population centers.

The size and composition of the proposed force was based on an examination of all factors such as the buildup of our own atomic stockpile, the improvements to be expected in our own weapons and in the enemy's weapons, and the expected size, nature, and disposition of Communist military forces. There have been no significant or unexpected changes in weapons development or in forces since the decision was made.

An Air Force consists of three principal elements—people, planes, and bases. The people include many kinds of specialists and most of these require extensive training. The planes are of many types and they all require extensive support in the form of

spares, repairs, and auxiliary equipment. Bases also are of several types in a variety of locations, and most of them require a long time to build.

A shortage in any one of these many elements which go to make up a modern Air Force may render the remainder of that force ineffective. To keep everything in gear and to enable the entire program to move forward on schedule and with economy requires a consistent and orderly progression to established goals.

Because of reductions in the manpower of supporting units and reductions in funds for maintenance and operations, the Air Force will fly fewer hours next year, with a greater number of wings, than it is flying this year. This inevitably means a reduction in maintenance standards and in standards of aircrew skill and experience.

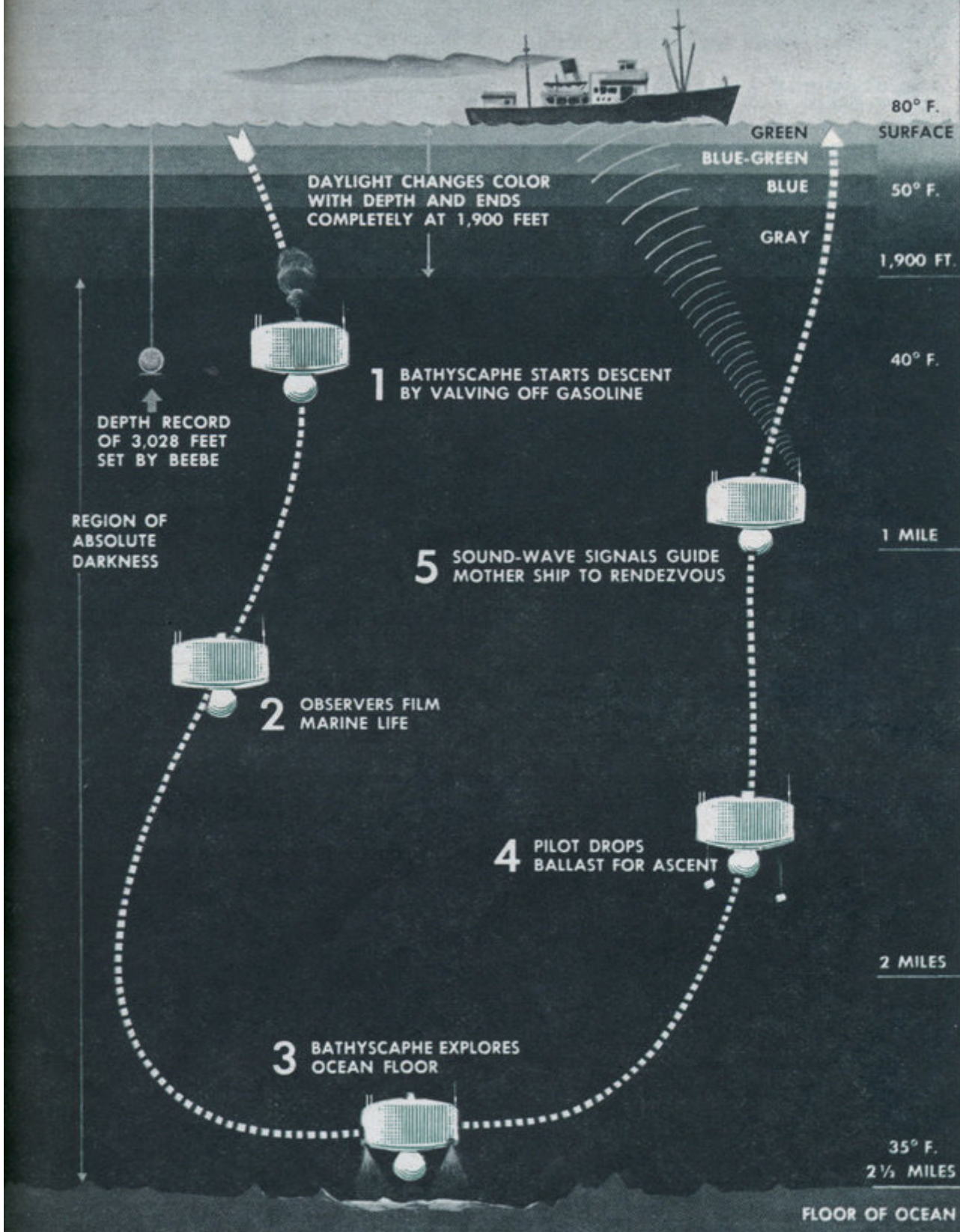
In addition, there will be a heavy reduc-

Attending the Academy of Crew and Pilot, Russia's top-ranking aces are constantly studying new methods of aerial warfare. All are veterans of the war with Germany.



Pilotless aircraft may be our prime defense against aerial invasion. B-61 Matador is prototype of such guided missiles.

DESCENT INTO THE UNKNOWN

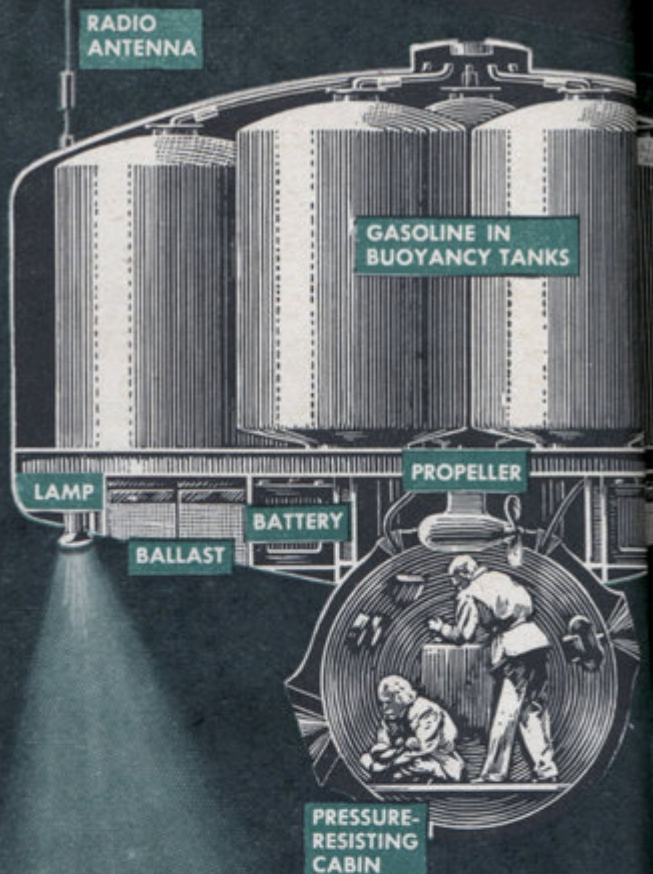


Plans for descent call for a perilous journey of eight to 10 hours to a depth where weight of sea overhead will exert titanic crushing force on the spherical two-man cabin. Drawing shows

how explorers will navigate the bathyscaphe and what they will encounter, as revealed by Beebe's pioneer dives in his captive bathysphere and by deep-sea soundings.



Piccard's Submarine Balloon



Professor Piccard's self-propelled "ship of the deep," with pressureproof cabin for pilot

A famous explorer of the stratosphere designs a remarkable undersea craft for a journey to ocean depths never before reached by man.

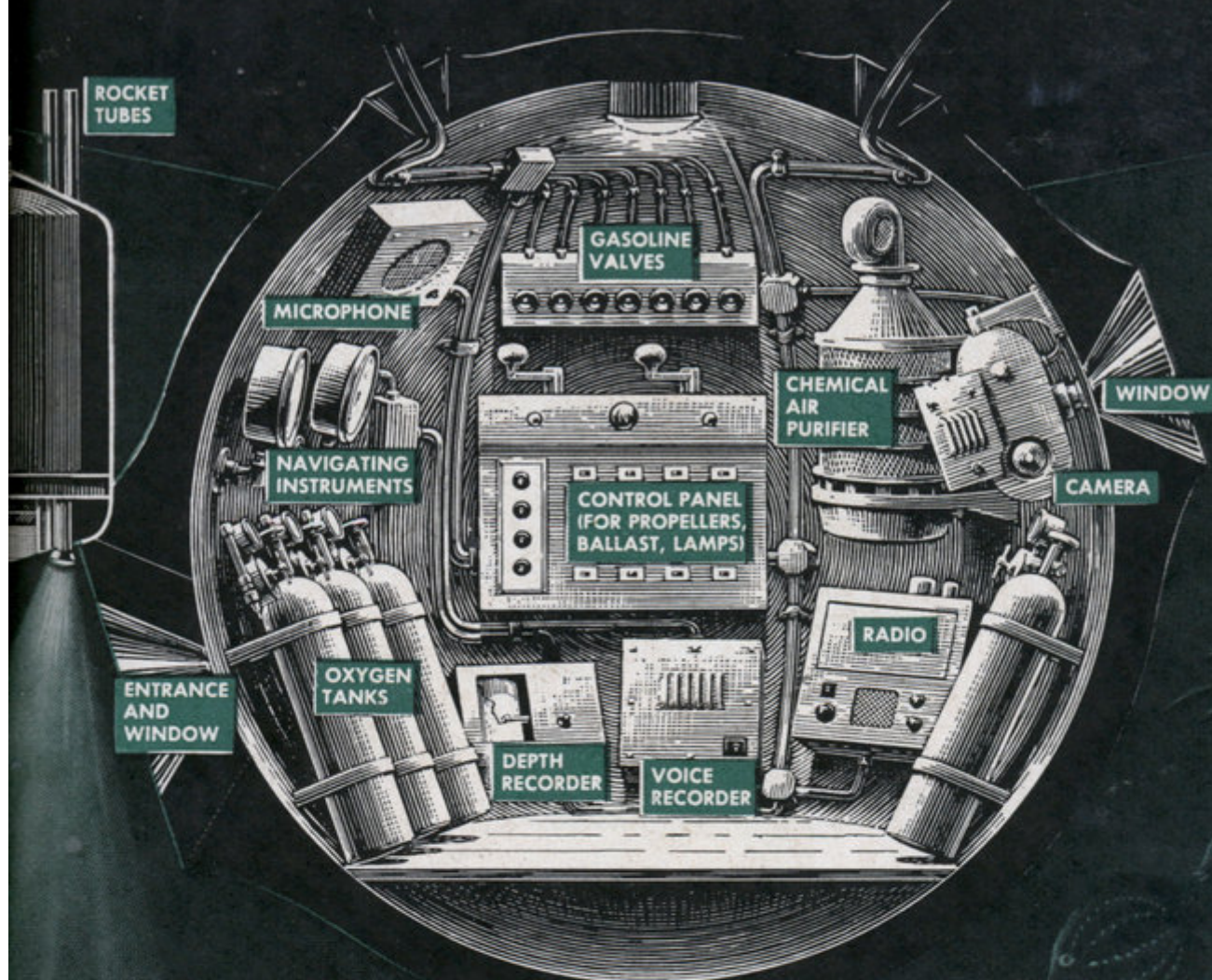
By Charles Wright,
Aneta News Agency Correspondent

BRUSSELS, Belgium—(Special to *Popular Science Monthly*). By applying the lifting principle of a balloon to a diving chamber, Prof. Auguste Piccard, pioneer explorer of the stratosphere, has found a way to descend to greater depths of the ocean than man has ever reached before. He has embodied his idea in a submarine craft of extraordinary design, able to navigate more than two miles beneath the waves. As this is written, he and his Belgian assistant, Prof.

Max Cosyns, of Brussels University, are preparing to entrust their lives to the invention in the Gulf of Guinea, off the Ivory Coast of Africa.

The existing deep-sea record was set in 1934 by Dr. William Beebe, of the New York Zoological Society, off Nonesuch Island, Bermuda. His spherical steel diving chamber, or bathysphere, was lowered to a depth of 3,028 feet by a steel cable.

Professor Piccard's subsea craft, in contrast, will not be suspended from its mother craft. Instead, it will navigate under its own power, driven by two propellers with elec-



and observer, is shown at left attached to "balloon." At right is view of cabin's interior.

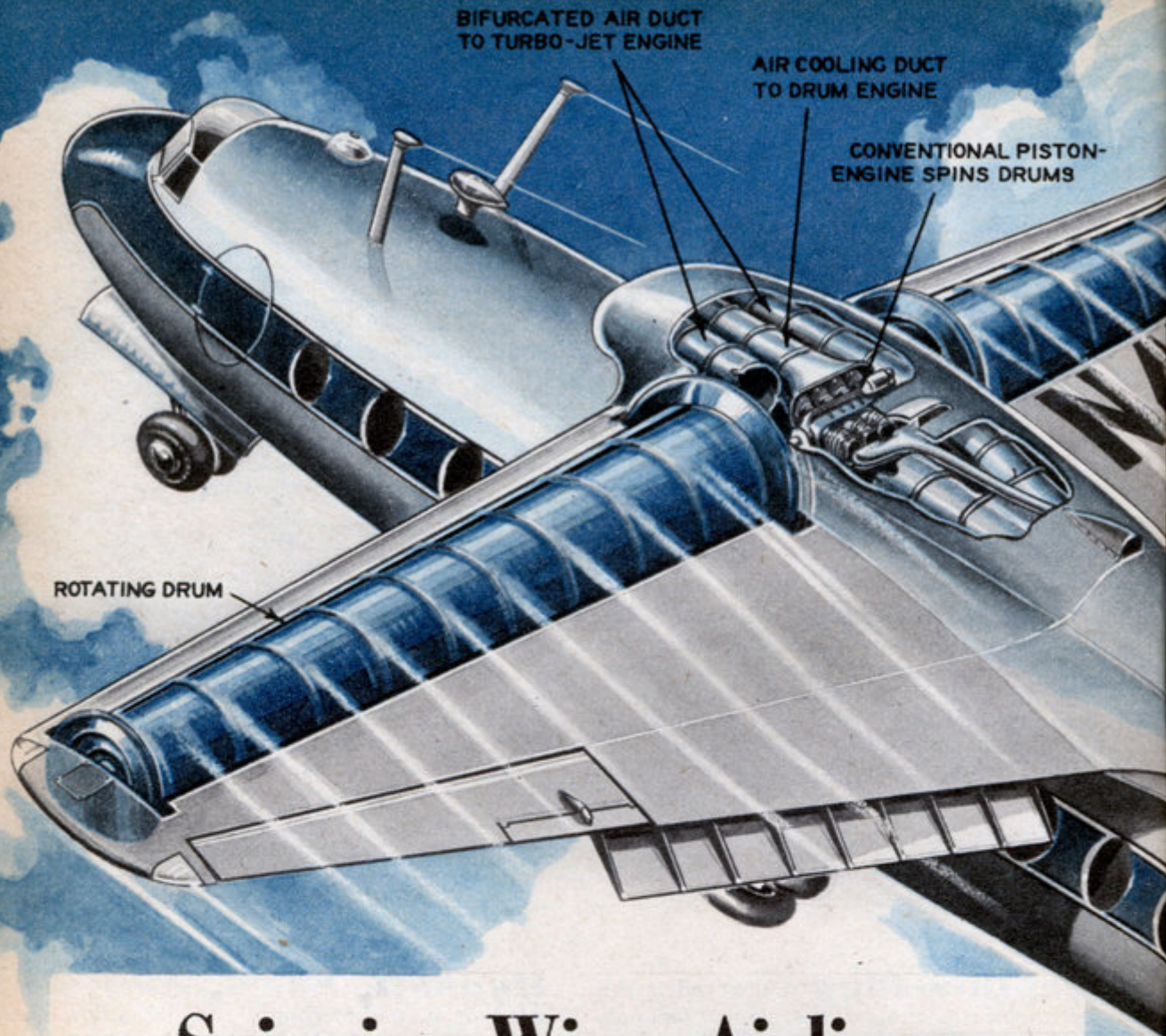
tric motors. The bushy-haired, 63-year-old, Swiss-born professor intends to take it down to a depth of two and a half miles, which is more than four times as far as Dr. Beebe went, to make scientific observations in an unexplored region of eternal night.

Armor Withstands Pressure

Combining the Greek words for depth and ship, Professor Piccard calls his craft a "bathyscaphe," or ship of the deep. Pilot and observer will ride in a hermetically sealed, alloy-steel sphere $6\frac{1}{2}$ feet in outside diameter. Its massive walls, $3\frac{1}{2}$ inches thick, will safely withstand the tremendous pressure of more than 5,700 pounds to the square inch—about a ton for every mile of

descent—resulting from the crushing weight of water overhead. Two windows of transparent plastic, measuring 16 inches in outside diameter, four inches in inside diameter, and six inches thick, give the crew a view into the lower depths. At the points where these ports are inserted, the walls of the sphere itself are correspondingly thickened for strength. The greater the water pressure upon the windows, the more tightly they are forced against their conical seats, preventing any leak. Electrical cables enter through smaller cones of plastic, similarly providing a watertight seal.

So that the men inside the globe can control its ascent and descent at will, Professor Piccard suspends it from a "balloon"—a



Spinning Wing Airliner

More wing lift and less drag are the major aims of aviation's researchers. Maybe the Magnus Wing will supply the answers.

ENGLAND'S aeronautical scientists may have a surprise in store for the rest of the flying world. Some years ago a prominent investigator, Anton Flettner, formulated the Magnus Effect—the strange behavior of a drum spinning in an airflow. Today with modern materials, equipment and wind tunnels, interest is once more directed toward this strange phenomenon.

The lift of an airplane wing is caused by the fact that the air passing over the top of a wing travels faster than that passing over the bottom. A law of science says that the faster air travels, the more its pressure is reduced. This difference in air pressure between the top and bottom of the wing results in lift. The addition of a rotating drum speeds up the air over the wing and slows up the air under the wing still more, resulting in still greater pressure difference and hence, greater lift. Early tests show an increase of 100 to 200 per cent.

Here is how one of tomorrow's airliners may appear should further experiments prove the idea practical. The ship is powered by a conventional gas-turbine jet engine, while the drums are revolved by a separate piston engine. Small wings, heavy loads and quick take-offs would be its great advantages. •

DRUM FLANGE ACTS AS
BOUNDARY LAYER STOP

TURBO-JET ENGINE
LOCATED AFT OF
CABIN SPACE

AIRFLOW

TURBULENCE

CONVENTIONAL AIRFOIL

LIFT INDICATOR

BOOSTED AIRFOIL (DRUM STATIONARY)

AIR SPEEDED UP

AIR SLOWED DOWN

BOOSTED AIRFOIL (DRUM ROTATING)

LIFT INDICATOR
SHOWS 100 PER
CENT INCREASE

JET NOZZLE

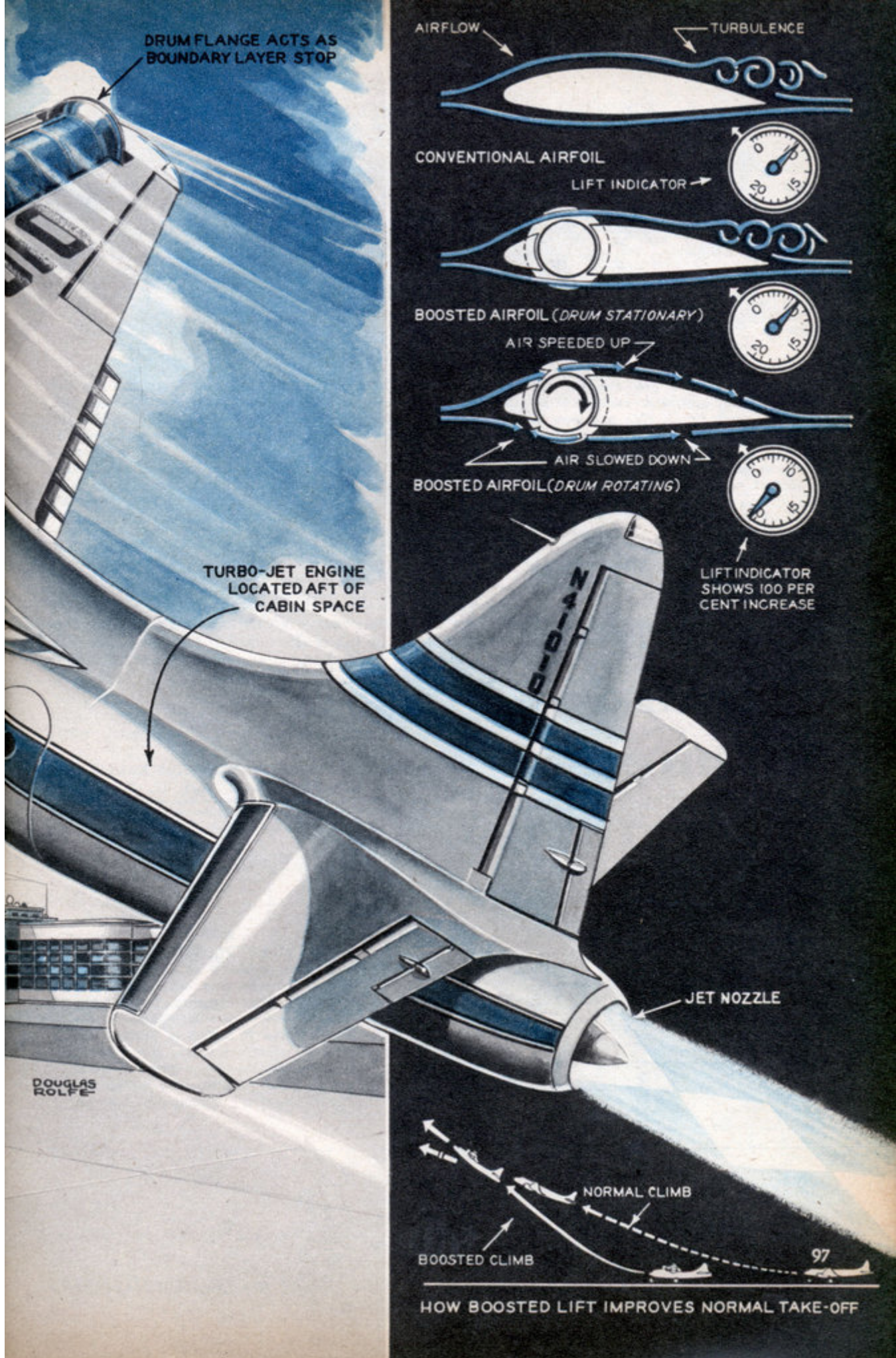
DOUGLAS
ROLFE

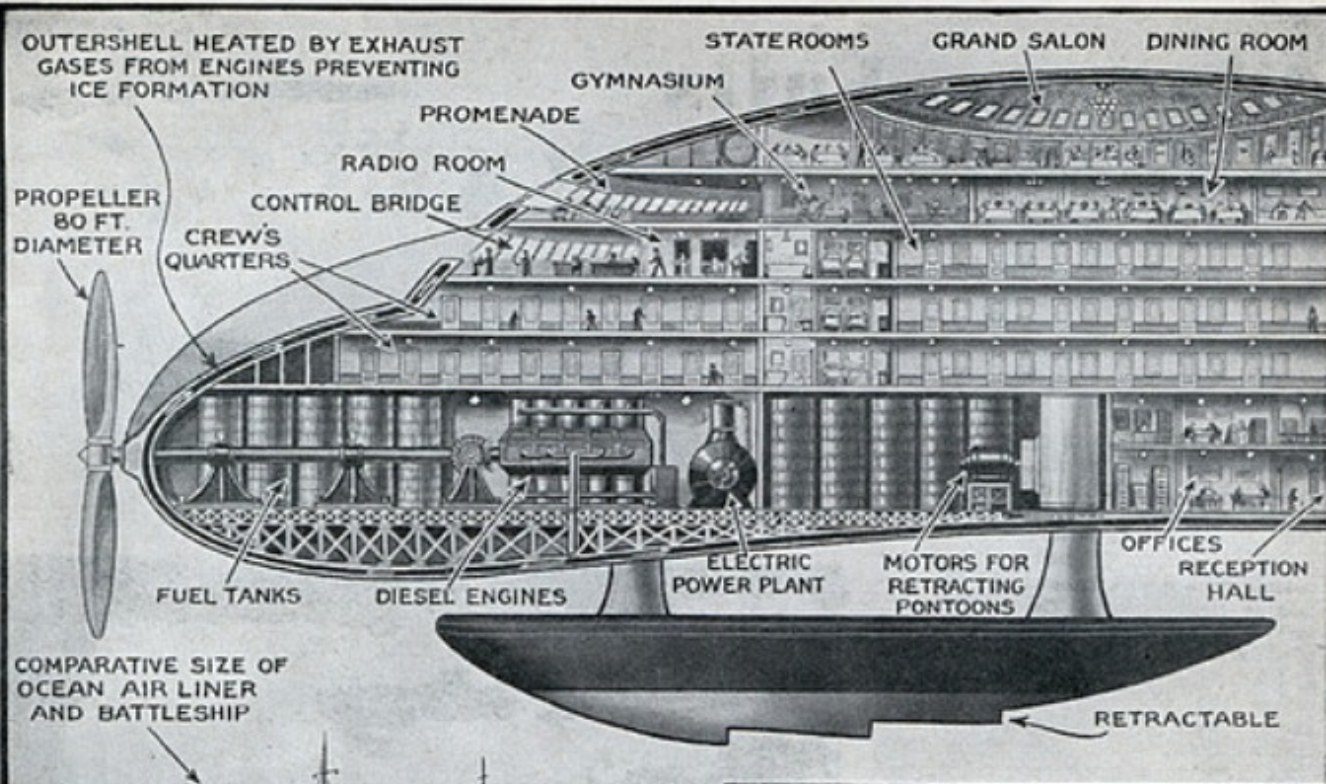
NORMAL CLIMB

BOOSTED CLIMB

97

HOW BOOSTED LIFT IMPROVES NORMAL TAKE-OFF



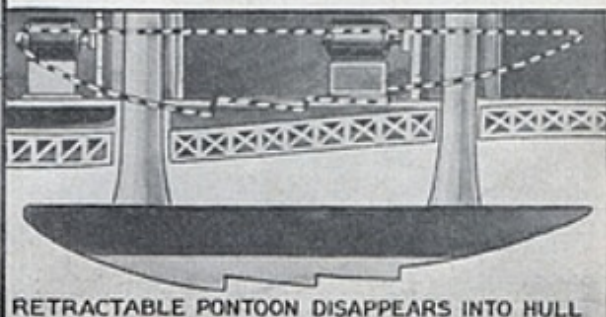
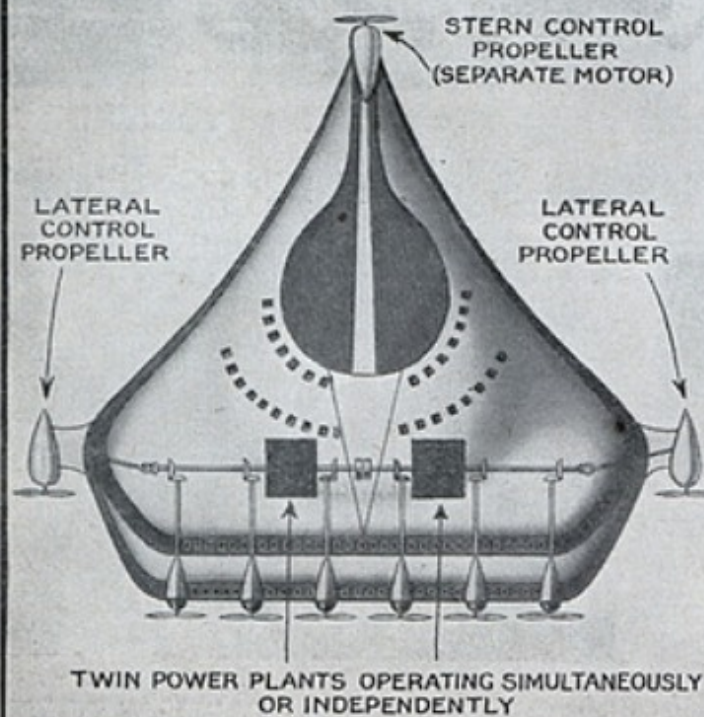


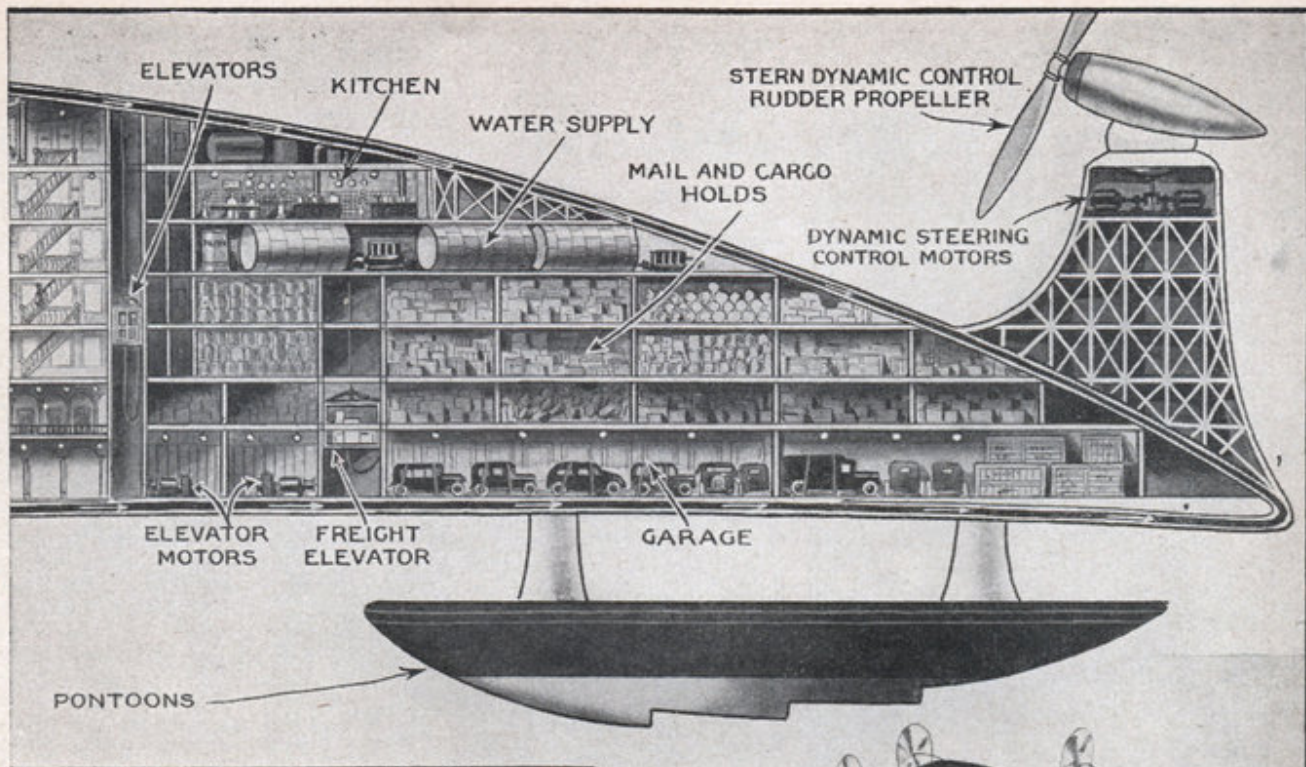
The "Dynamic Ocean"

By HUGO

● THE tendency at the present time in airplane building is toward constantly increasing size. It is probably realized by all who have concerned themselves with aircraft that the larger machines are not very far in the future. From the earliest Wright airplane, which weighed approximately $\frac{1}{2}$ ton, to the present record holder, the DOX, which weighed fifty tons, took a period of some 26 years. The 10,000 ton airplane, projected on a like time-scale, would, therefore, make its appearance not later than the year 1952. However, with the nature of the present-day technique, it is quite possible, at this moment, that the 10,000 ton plane will be here much sooner.

It is already becoming apparent that ideas of the ordinary ocean liners are more and more embodied in airplane construction; and in all probability this tendency will be followed in years to come. In other words, what we will have is a *flying ocean liner* that





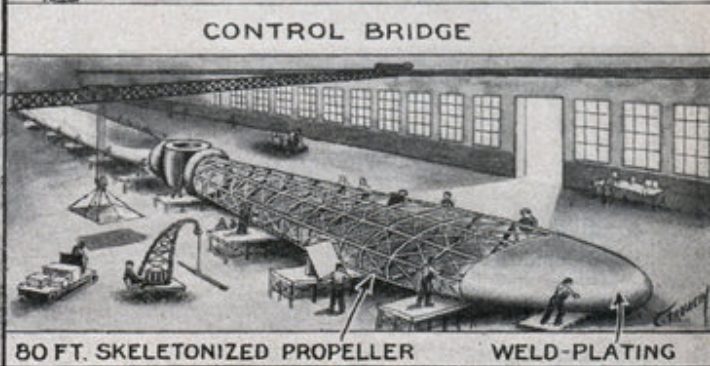
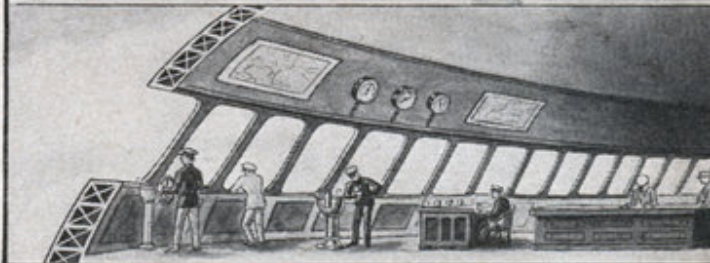
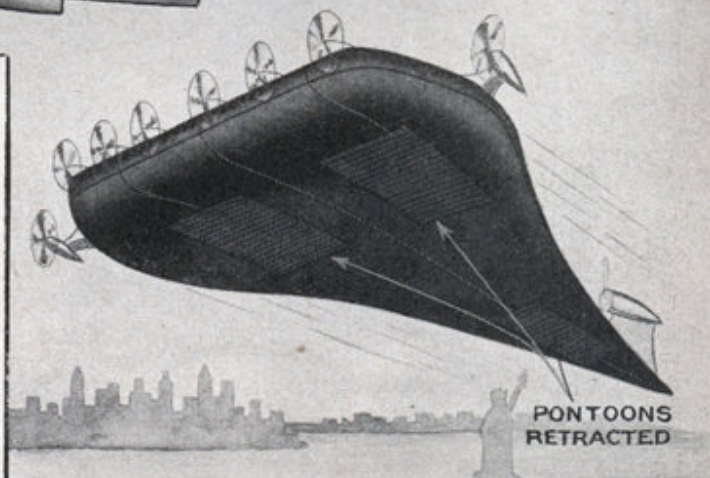
Control" Airliner

GERNSBACK

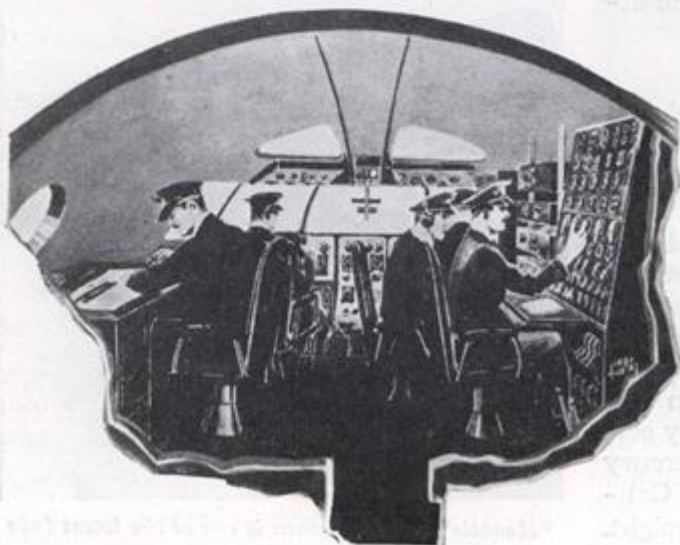
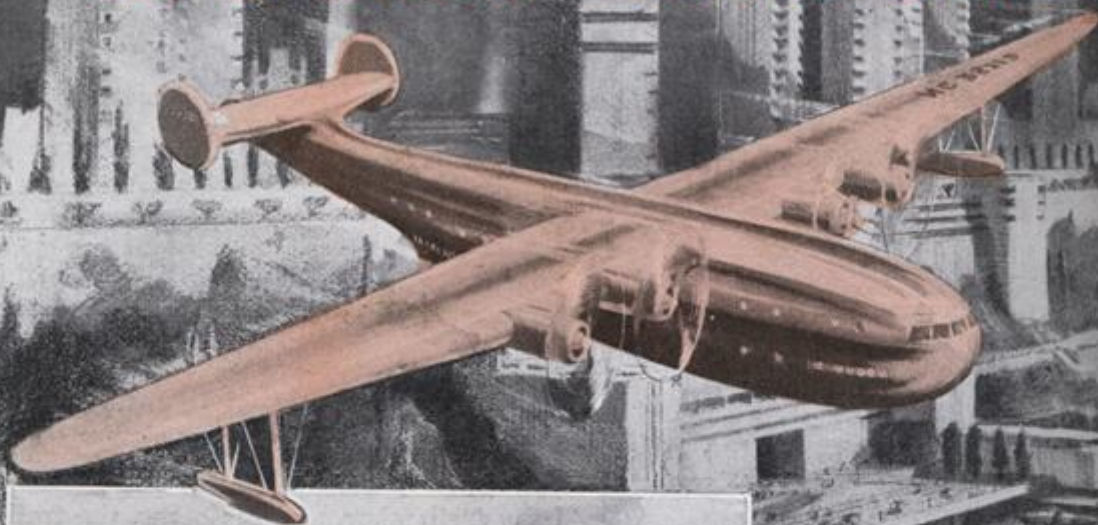
is not only *airworthy*, but is *seaworthy* as well. It is also a foregone conclusion that when a 10,000-ton aircraft is built, it will not be a land-type plane but for obvious reasons will have to land in water. This makes the landing and taking off much easier and more practical; because it would be most difficult to take off with, or land, a 10,000-ton weight on *terra firma*.

The question may be raised, why such a large craft? The same principle that holds good for large ocean liners holds good for large airplanes. In the first place, in order to make it as economical as possible, the craft must carry a sufficient amount of freight and passengers, and it must also be sufficiently speedy; and, if past history is a teacher, it will be found that higher and higher transatlantic speeds are needed. The new French express steamer, *Normandie*, will make the Atlantic crossing from

(Continued on page 613)



TRANSPORTATION



Top, drawing of "flying hotel" which might be plying the stratosphere if war had not delayed plans of the Glenn L. Martin Company, its designers. Center, left, design for big-city seaplane base created by the Austin Company. Right, drawing of observation room in "flying hotel." Bottom, drawing of same plane's control deck

of TOMORROW



Above, Hudson River skyline of New York City of the future, as Dr. C. V. Paterno sees it. Note autogiros. Right, the author's design for twin-stack liner in which space between funnels would be used for night club

By Otto Kuhler

Consulting Designer on Transportation

CIVILIZATION has stood aghast at the role the airplane has played in altering the map of the world and changing the skylines of bombed cities scattered all the way from Europe to the Orient.

Before many years, when the world has had a chance to bind its war wounds and turn its attention to the improvement of what is left of civilization, the impact of the airplane on other forms of transportation is likely to be as awe-inspiring as those first mass-bombing attacks on the great city of London.

In fact, there is plenty of rational evidence that the railroad train, the ocean liner, the motorbus and the streetcar will be quite different from the mass transportation vehicles we now see on land, in water and in air. Modern industrial design is

very strongly functional. And as each of these vehicles is forced to change its purposes by pressure of competition from the airplane, it will change its form.

The airplane of the future, on the other hand, is very likely to retain its general lines as we know them, because, as the submarine is shaped somewhat like a fish, the plane is a rough copy of one of nature's most efficient inventions, the bird.

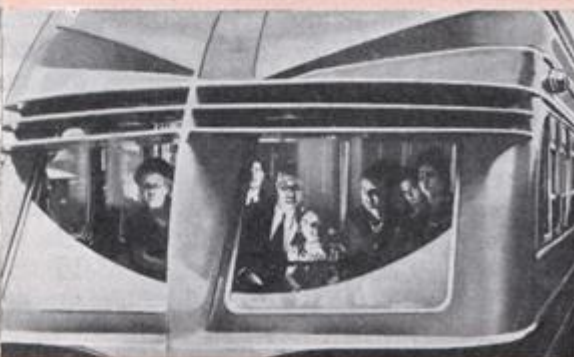
The long-distance air liners of the future, however, will be veritable flying hotels, so great that one of them could enfold the army's new 164,000-pound bomber under a wing like a hen nestling a chick. Only the power problem—the ratio between weight and the propulsion output of the relatively inefficient gasoline and Diesel motor—limits the size of aircraft today.



Above, students and instructor at Pratt Institute building a model airport of the future in which wide-flung runways are condensed into small area by unique design. Left, double-end rail car which the author predicts forecasts double-end multi-car reversible train of the future



Station stops in Philadelphia's subway coaches are announced by automatic electrical device



Like something right out of the future is this rear-end view of the Milwaukee Road's Hiawatha train with rear-vision car, shadow aprons and fins for additional structural strength

During the various stages of progress the motive power of the plane may be the turbine using steam or mercury vapor or the rocketlike blast of exploding vapor created by the combinations of yet undiscovered chemicals. These power devices are probably destined to prove make-shifts, however, and the plane of the future is likely to be propelled by one, or all of three scientifically feasible methods.

One may be the sunplane, the most notable feature of which will be its enormously widespread wings, the surface of which will be treated so as to capture the power of the sun's rays and turn this energy into enough force to lift and drive the craft. These will need auxiliary power for cloudy days unless a new method of storing energy is discovered. Scientists of today are already moving little machines with this same sun power, so the sunplane is not at all unlikely to develop.

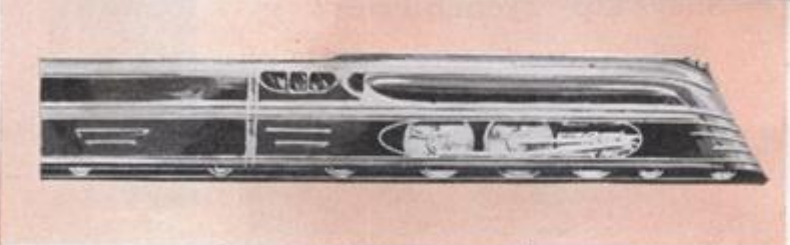
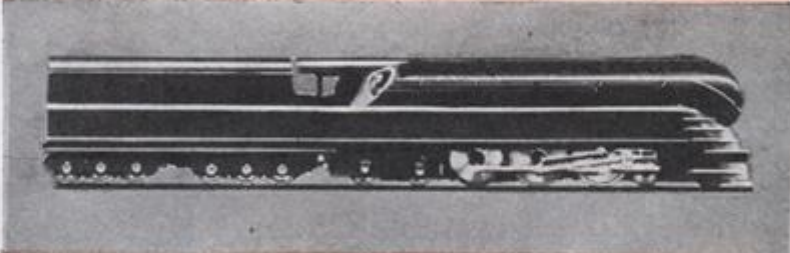
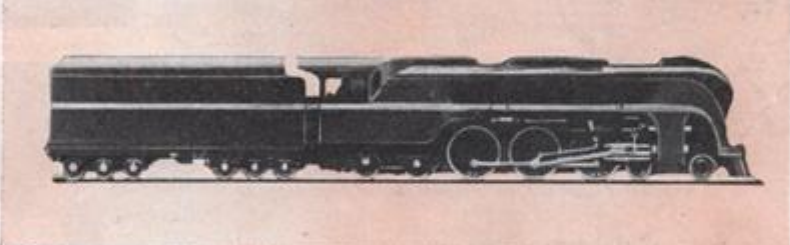
The second will possibly be the beam-

plane which will take its power from radio stations, just as airplanes of today are taking directional signals on beams from airport radio stations. Research engineers are already broadcasting power through the air and are lighting lamp bulbs with this unhooked energy. You may be able to get into your plane in Chicago, tune in for New York and "click" off you go.

The third likelihood is the magnetic plane which will sustain its flight by establishing its own magnetic field of sufficient strength to overcome the force of gravity and which will be propelled by the counter forces of attraction from one magnetic current to another, much as the glider of today uses air currents. Ships plying the ocean right now are setting up their own magnetic fields to offset the fatal attraction they hold for magnetic mines.

Whether turbine, rocket, sunplane, beamplane or magnetic plane, all of them are almost certain to take advantage of the greatest moving force that exists in our nook of the universe—the revolving action of the earth itself. It is pretty safe to predict that airplanes of the future will rise so high in the stratosphere that they will be able to overcome gravity and stand still in the great silent reaches of the sky and let the ground far below them fly past at a rate of more than one thousand miles an hour.

Just as the utter necessity for streamlining airplanes has already taught the builders of railroad equipment, ships, motorbuses, streetcars and automobiles the advantages of cutting air resistance and



Top, Rock Island Railroad's Rocky Mountain Rocket, constructed by American Locomotive Company, has locomotive streamlined by the author. Next four illustrations, reading down, show evolution of modern streamline in steam locomotive, with last one a glimpse of the future

thus changed the shape of these vehicles in the past ten years, so will the giants of the air keep forcing more changes.

Flying freight trains of five and six planes of the autogiro or helicopter type

(Continued to page 144A)

SPRING HOSE REELS

SUPPLY GEAR OIL, SPRING
LUBRICANT AND WATER

REVOLVING ARM
OF PIPE CARRIES
CHASSIS LUBRICANT
HOSE

OIL DISPENSER

SUPPLIES FOUR TYPES
OF ENGINE OIL THROUGH
HOSES ON REELS

BRAKE-
REPAIR
TOOLS

GLASS
WATER-
SPLASH
WALL

WASHING STALL

EQUIPPED FOR HIGH-
PRESSURE WASHING,
WAXING AND COMPLETE
UPHOLSTERY CLEANING

LUBRICATION

STALL HAS DRIVE-ON
LIFT AND IS EQUIPPED
FOR VERY FAST
ROUTINE JOBS

EXHAUST
ANALYZER

SPECIAL JOB STALL

FREE-WHEEL LIFT ALLOWS
REMOVAL OF WHEELS FOR
GREASE PACKING, TIRE
CHANGING AND THE LIKE

ELECTRIC
TEST RIGS

RADIANT-HEAT SYSTEM

THIS BOILER SUPPLIES A FLOW OF
HOT WATER TO A GRID OF PIPES
EMBEDDED IN THE CONCRETE
FLOOR OF ENTIRE BUILDING

REST ROOMS

SALESROOM

REPAIR STALL

TWO-POST TYPE
LIFT MAKES ENTIRE
UNDER SIDE OF CAR
ACCESSIBLE FOR
REPAIRS

NEW-TYPE PUMP

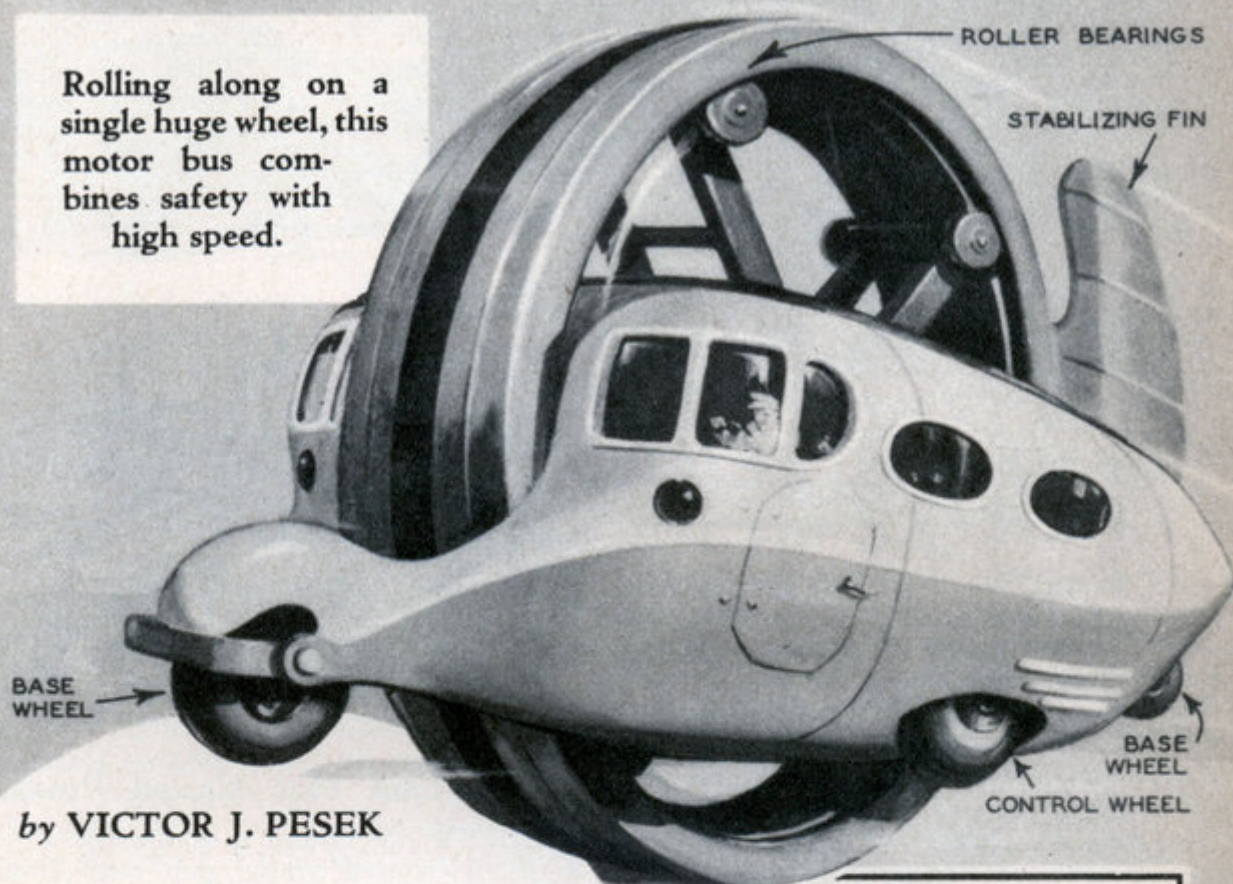
HAS GASOLINE, WATER
AND AIR HOSES ON REELS

"TOMORROW'S" GAS STATION

You may never drive up to a service station that looks exactly like this, for it contains almost every attractive improvement with which seven of the biggest oil companies hope to lure customers away from each other when materials and labor are available. In addition to what you can see, most stations will have fluorescent lighting. Some will have transparent glass partitions.

DYNO-WHEEL Drives New MOTOR BUS

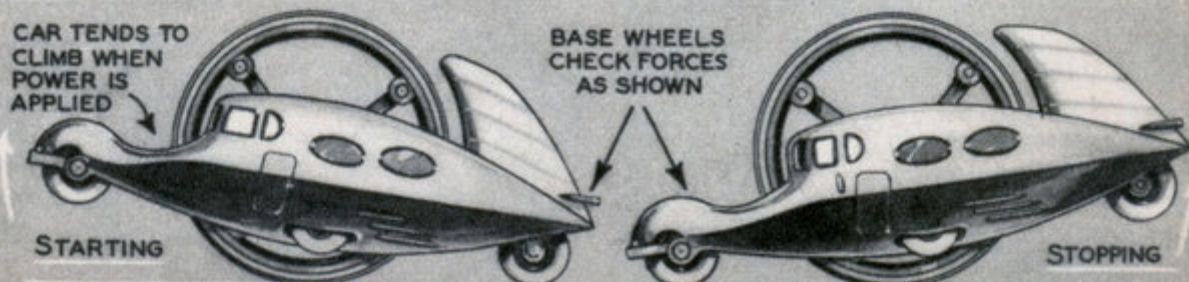
Rolling along on a single huge wheel, this motor bus combines safety with high speed.



by VICTOR J. PESEK

PPROMISING to revolutionize the field of motor transportation, the new Dyno-Wheel bus operates upon practically the same principle as the tiny "Dynasphere" auto which was successfully built by Dr. J. A. Purves of Taunton, England, some years ago.

A single huge drum wheel supports the car at high speeds. Control wheels on either side are raised or lowered in response to the steering gear, to tip the bus slightly and change the direction of travel. Small fore and aft wheels come into action only when stopping or starting. A stabilizing fin keeps the car level at high speeds.



FUNCTION OF FORE AND AFT AUXILIARY, OR BASE WHEELS EXPLAINED ABOVE

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

NEW

25¢
JULY

CAN GUIDED MISSILES
SAVE US FROM
A-BOMB HAVOC?

See Page 76

USE AMAZING NEW ROCKET FUEL TO MAKE YOUR GARDEN GROW
BUILD AN ATTIC FAN TO COOL YOUR HOME

How You Can Spot A Suitcase A-Bomb

Don't bury your head in the sand. Learn the secrets of the saboteurs and help to protect your country.

By Frank Tinsley



This story has been read and its contents endorsed by Martin Caidin, Atomic Warfare Specialist for the New York State Civil Defense Commission and one of the nation's leading authorities on atomic bombing. "Mr. Tinsley is to be congratulated for this public message," Mr. Caidin states. "The public has good cause to heed carefully this data which may one day save their lives."

BABY A-BOMBS, small enough to be carried in a suitcase and set off by self-contained timers, are a real and immediate danger to the safety of our country!

This is the gist of a warning that has been quietly circulated by the F.B.I. to law enforcement agencies throughout the United States. The details of this menace have been played down in many newspapers and magazines for fear of starting a public panic. Remembering the hysterical reaction to Orson Welles' famous broadcast of an imaginary Martian invasion, officialdom seems to think that the American people just can't take it. They point to the wave of H-bomb hysteria that has swept the world and have decided that if ignorance isn't bliss, it is at least the next best thing to it!

Your editors can not subscribe to this head-in-the-sand theory. Rather, we agree with Dr. James Beckerley of the Atomic Energy Commission, who said, "An ostrich-like attitude about atomic information

could lead to catastrophe!" We in MI feel that Americans can "take it" and that the hazards of A-bomb sabotage can be materially lessened by putting an aroused public on its guard. We believe in the old saying: "Learning to recognize your enemy is half the battle." The translation of unknown terrors into identifiable risks is the first step toward a calm, steadfast courage that ultimately conquers them.

Sneak A-bombs pose a truly terrible threat—the stab-in-the-back of Pearl Harbor multiplied a million times. However, like all weapons, they have their limitations. The main ingredient, Plutonium, is neither common nor easy to come by. It must be smuggled past our borders or stolen from well-guarded government plants in this country. The latter is a distinct possibility. Medford Evans, formerly of the A.E.C. and author of "The Secret War For The A-bombs," states that "It is probable that fissionable material has been diverted in quantities sufficient to make as many as 20 atomic bombs." He believes that these already have been made and are ready to be assembled and set off if and when the time comes!

The actual detonating mechanisms present no problem to a saboteur. They can be made in any machine shop with the parts scattered among enough establishments as to be unidentifiable. There must be thousands of small "model making" shops in the country, accustomed to dealing with suspicious and secretive inventors who farm out the making of their precious brain chil-

MI Plants A Suitcase A-Bomb

Attempting to show just how easy it would be for an enemy saboteur to plant a suitcase atom bomb in a vital part of one of our major cities, an MI staff member left an 80-lb. suitcase "bomb" on the street near Grand Central Station, N. Y., for more than 30 minutes.



dren in parts. However, the assembled bomb or its components must be transported and set up in strategic areas and the parts are sufficiently unusual in form and material to be recognized. This is the weak link in the saboteur's chain that we can guard against. It is not a sure or easy defense but universal watchfulness can materially reduce the odds against us. This is the best we can do. It is just another of the "calculated risks" that free men must face.

Who are the self-appointed sentries to mount this vital guard? You are. I am. Everyone can keep an eye peeled—especially those of us who deal with strangers on the move. Taxi drivers have an important function to perform since the least obtrusive way to carry a suitcase or large bundle is by car. So have rent-a-car operators, garage men and service station employees. Baggage checkers and expressmen, porters, doormen, bellhops—anyone who handles strangers' grips, should be on the lookout for luggage or packages that are unusually heavy for their size. Keepers of motels and tourist homes in areas adjacent to defense plants, dams and large power stations should be especially watchful. Several ostensible strangers carrying components could meet at such a motel and assemble a bomb in the privacy of a cabin.

But public places and vehicles present a danger to the saboteur. Hotels and terminals are discreetly watched and taxi drivers are sometimes curious. So a private car is a more likely form of transport and a small office or apartment in a busy section is a more likely hide-out. Renting agents, janitors, elevator operators, charwomen and service personnel should be on the alert

in such buildings. Keep an eye out for odd-shaped machine parts, visitors arriving with small, weighty bundles. Study the shapes of typical A-bomb components shown in the accompanying illustrations. However camouflaged, these forms are basic.

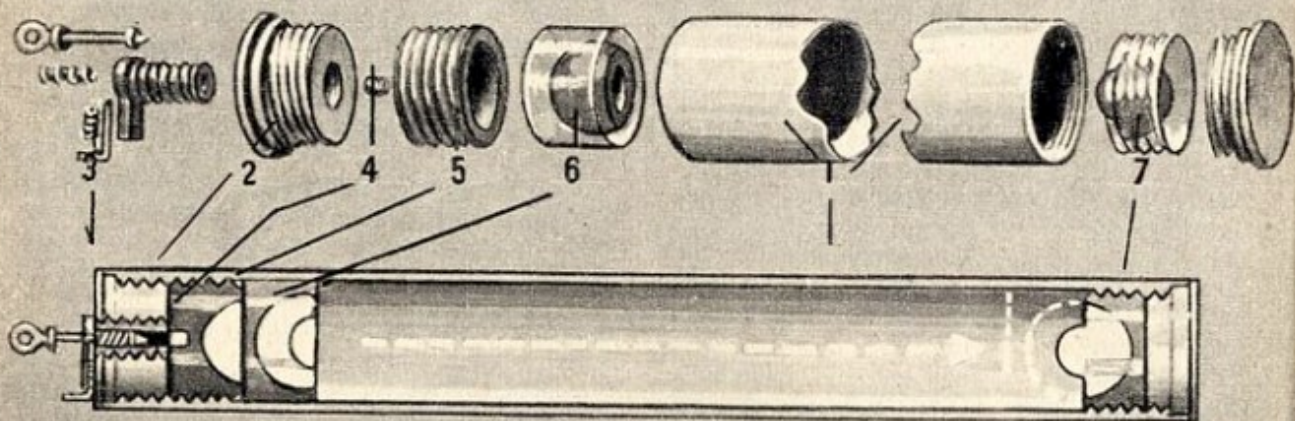
Two completely different types of bombs are described in the F.B.I. warning—the early "gun type" mechanism and the later "implosion type." Both are based upon the "critical mass" characteristics of atomic fission. All Plutonium radiates neutrons. In small lumps, however, these tiny, atom-cracking hammers escape harmlessly into the surrounding atmosphere. It is only when the lump becomes large enough to contain its neutrons and put them to work splitting adjoining atomic nuclei that an explosive chain reaction begins. This critical mass is about the size of a softball or grapefruit and weighs approximately 50 lbs. In any atom bomb it is divided into two or more segments which are brought forcibly together to cause the explosion.

The gun type of bomb is very simple. It consists of a gun-barrel-like tube containing a hemisphere of Plutonium at either end. One of these is fixed in place. The other is movable and is backed by a propulsive charge of high explosive such as TNT. When the TNT is set off by a mechanical trigger or electric primer, it blows the movable lump of Plutonium violently against the fixed segment. Together they are large enough to form a critical mass and an explosion follows. To assure complete joining, one hemisphere is usually hollowed out to receive a projecting stud on the other. Sometimes a complicated surface of intermeshing "dovetails" is used. For ac-

Convinced that he was "safe" on the street, our man next tried to look suspicious inside station.

Finally he got a porter to plant the suitcase in a locker. Soldier at right never turned around.





Schematic diagram of the gun type A-bomb and its component parts. In this earlier form of bomb mechanism two segments of Plutonium are shot together, forming a single mass of fissionable size. This is the type of bomb that is most easily concealed in a suitcase.

1. Gun-barrel-like casing, internally threaded at either end. It must be made of steel strong enough to contain propulsive pressures.
2. Screwed-in cap closes breech end of tube and contains the firing mechanism.
3. Trigger, firing pin, springs and housing.
4. Primer is set in base of propulsive charge.
5. High explosive shaped charge, screwed into breech, propels movable Plutonium.
6. Movable segment of Plutonium, encased in a plastic "bullet," is driven through the tube to join its fixed, sister segment.
7. Fixed segment of Plutonium is encased in a threaded plastic plug and screwed into the muzzle end of tube. Male and female joints assure complete fission.
8. Muzzle cap closes end of tube, acts as anvil for Plutonium fusion.

With one "bomb" planted, attention was turned to the tunnel under First Ave. near the U. N. building. Despite warning sign our "spy" was ignored.

Then it was on to the George Washington Bridge. Suitcase placed under bridge support was noticed but untouched by passersby, two police officers.



curate positioning both are sunk into round, plastic or metal plugs which fit the inside of the tube. The female segment is threaded into the bore and is backed by a screwed-in anvil cap. The male segment is a squeeze fit and functions like a bullet in a smooth-bore musket barrel.

The implosion type of A-bomb is based upon the same theory but it is a bit more complicated to build. It is spherical in form and somewhere between 20 in. and two ft. in diameter. Basically the bomb consists of some 36 rounded segments of high explosive, shaped to fit together like the key-stones of an arch to form a hollow ball. Each segment or "lens" is roughly analogous to the "shaped charge" of a bazooka shell, being scooped out on its inner face to focus the force of an explosion inward. Hence, the term "implosion."

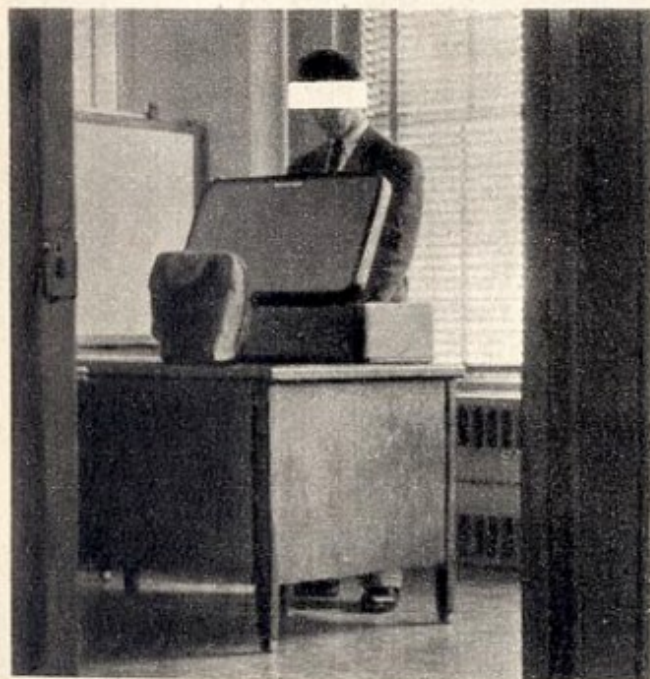
Attached to the inner face of each lens, directly over the hollow, is a four-sided, wedge-shaped piece of Plutonium. When the lenses are exploded simultaneously, these wedges are driven inward to combine in a mass of critical size. Some bombs include a small central ball of Beryllium—Radium or some other supplementary neutron source which hops up the chain reaction. In a slightly simpler form of implosion bomb the Plutonium is in the form of a highly porous sphere with a hollow

center. When the surrounding lenses explode inward, the Plutonium is compressed into a critical mass of normal density. Again, a center ball of Beryllium—Radium expedites the blow-off. Parts and assemblies of both these types are shown in the illustrations.

Due to the danger of handling and transporting, A-bombs are almost never finally assembled until just before using. It is important, therefore, to learn the basic shapes of all these components. Plutonium is a silvery gray, metallic substance, "slippery" feeling and heavier than even lead or gold. TNT is comparatively soft, a dirty yellow in color and has a "soapy" feel. Do not expect to find bomb parts in their natural form, however, as they can easily be disguised, both in shape and surface appearance. They can be buried in innocent-looking machine parts, moulded into blocks of opaque plastics, or plated to change colors, textures, etc. Nevertheless the basic shapes of the high explosive lenses, Plutonium wedges or sectioned spheres must be in there somewhere, easily removable and ready for assembly. One point to remember: Plutonium can be so shielded that it is immune to detection by a Geiger Counter. The simple passing of such devices over a suspected case or package is not conclusive!

Back in a sparsely-furnished midtown office, the components are assembled into a bomb by our man. This could be done in almost any office, hotel.

Bomb can be planted right in rented office if building is close to target. Bowling ball disguises explosive core in another type of bomb.



Special Section: HOW TO HAVE FUN OUTDOORS

MECHANIX ILLUSTRATED

THE HOW-TO-DO MAGAZINE

Best Buy
25¢
JUNE



HERE IS THE HOUSE YOU'LL LIVE IN TOMORROW
NEW MONEY-MAKING SECRETS • McCAHILL TESTS

What's Going On Here?





For the Answer,
Turn the Page

Gurney Miller



CITY OF THE FUTURE might look like this with a residential section of dome homes.



You can enjoy fresh spring weather year 'round in this home under a glassteel dome.

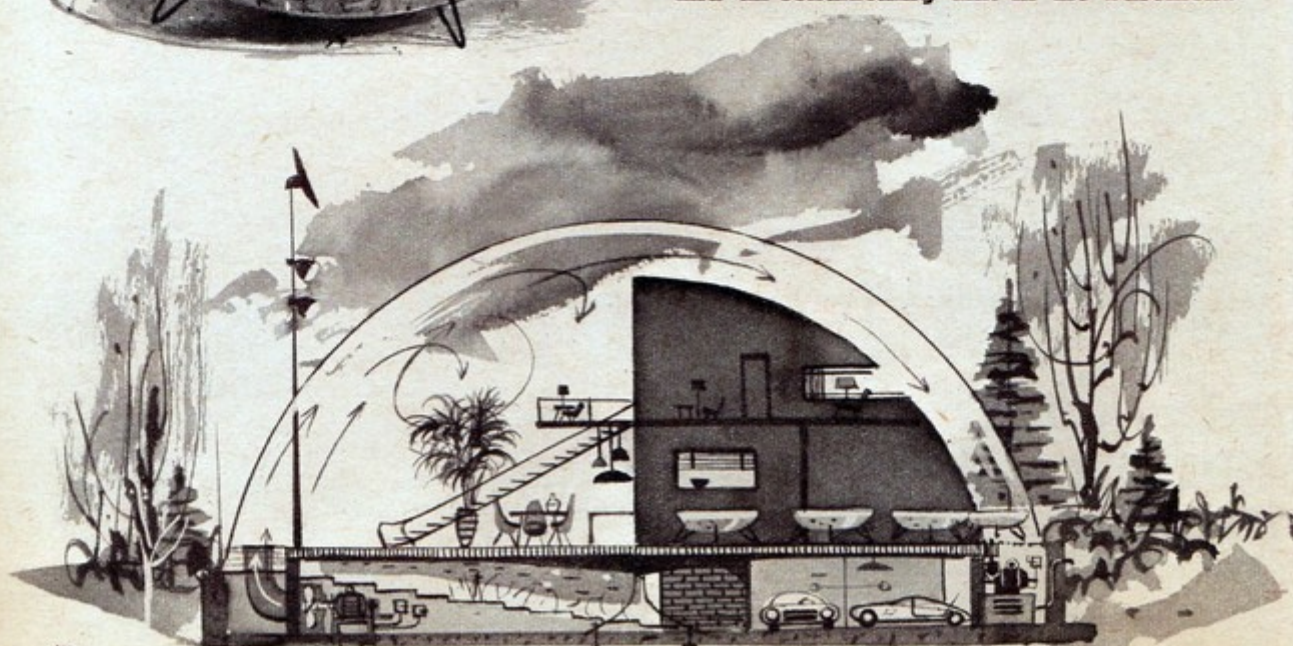
Illustrations by Gurney Miller

CURRENT research in solar energy and architecture indicates that by 1989 you may be living in a house with an exterior made entirely of steel-hard glass.

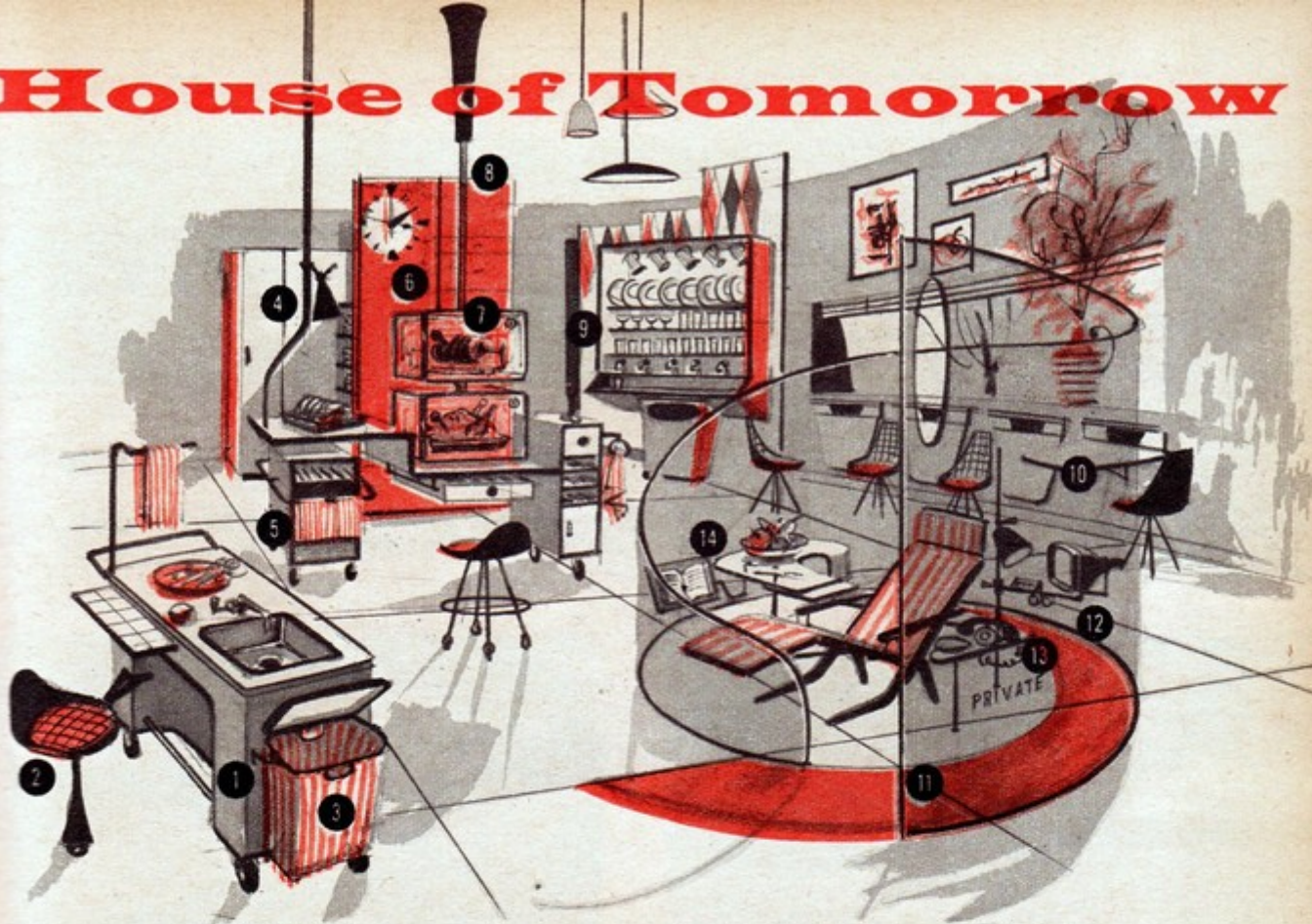
Efforts to bring the outdoors into the living room, particularly in California, and to make use of the sun's incredible energy already have led scientists and designers to some startling new shapes for homes. Eventually the outside form probably will resemble half a sphere sitting on the ground.

Inside this glass dome the living quarters may be mounted on a turntable permitting the house to revolve in phase with the sun. MI's design foresees an electronic tracker which keeps the structure facing directly into or away

HYDROPONIC GARDENS (left) grow vegetables for table use and flowers in large vats. Diagram below shows layout of turntable holding living quarters with the garage and air-conditioning unit in the basement.



House of Tomorrow



KITCHEN of tomorrow features: 1. Portable sink; 2. Swing-out stool; 3. Waste; 4. Frozen food thawer; 5. Grill; 6. Radio clock; 7. Radar oven; 8. Column lifts oven into ceiling; 9. Bar; 10. Snack tables; 11. Glassed-in "quiet spot" for housewife; 12. TV; 13. Intercom; 14. Book rack.

from the sun or at any other angle the owner desires.

A large and efficient air-conditioner maintains proper temperature and humidity inside the dome. Power for this unit, as well as for cooking and illumination, is provided by solar batteries which convert the sun's rays directly into electrical energy. At night and in foul weather artificial sunlight is provided by lamps, and power then comes from storage batteries.

Although the basic design for all dome homes is virtually the same, considerable individuality can be produced in the living quarters. Only this center section revolves on the turntable. Between its edge and the dome is a stationary strip several feet wide for year-around lawn, a swimming pool, play area and large vats for soil-less hydroponic vegetable and flower gardens.

CONSERVATIVE CHAP unable to give up old styles will go for this model.

There necessarily is only one entrance to the house. It is a stairway to the first floor from a circular landing beside the garage in the basement. The landing is located in the center of the building so that no matter which way the house turns the stairs deposit a visitor at the same place.—*Robert G. Beason* •



STEREATRONICS

A New Science that Will Change Your Way of Life



TV set of the future (as designed here by GE) is thin enough to hang on wall

Tiny solids are turning the electronics industry upside down. Some vibrate, others change light to energy or energy to light, or direct current to alternating. Together, they spell revolution



Simple solids like these, some almost microscopically

By CORNELIUS RYAN

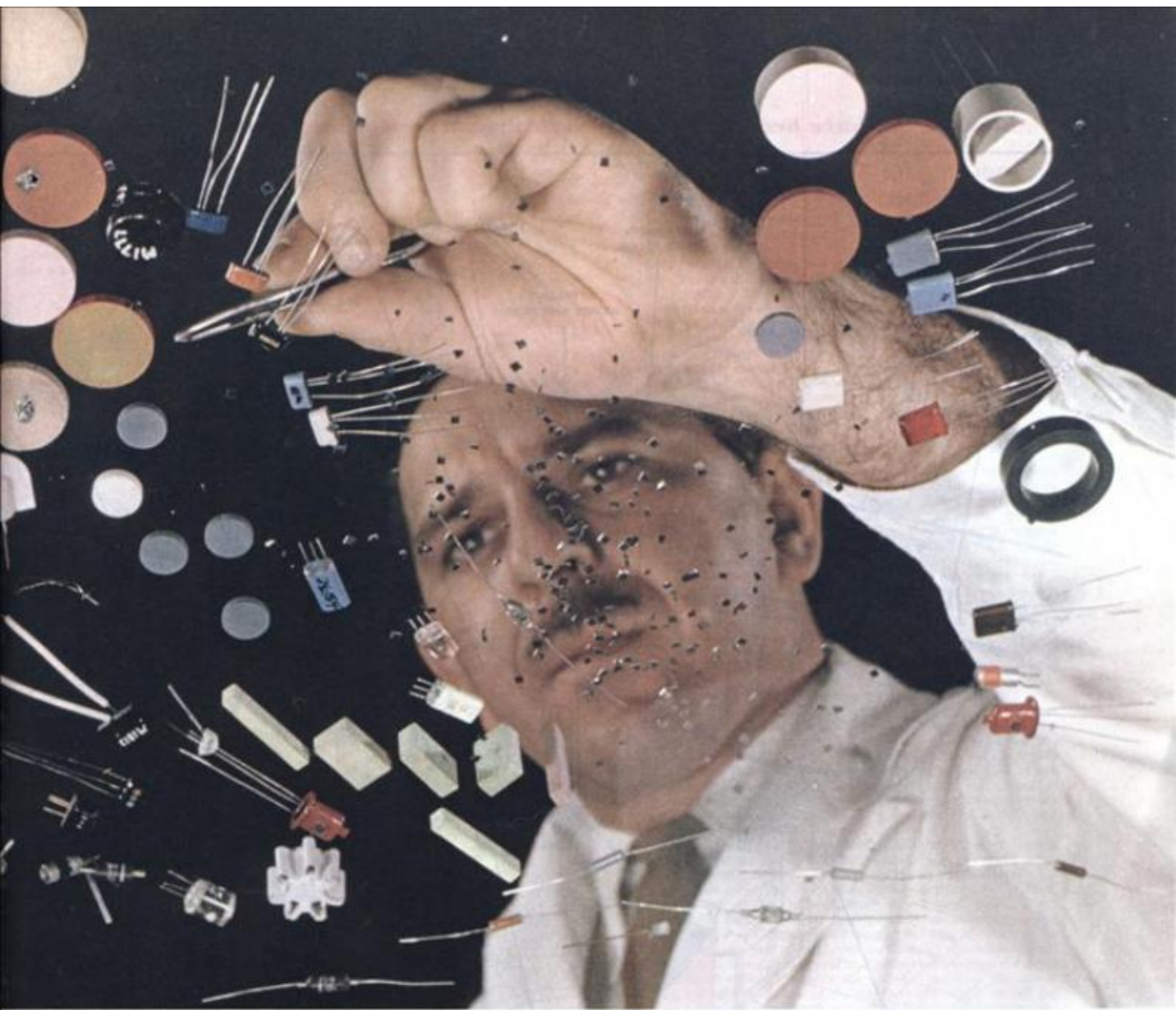
A NEW science, stereatronics, has been creeping up on us in the last few years and has started to make major changes in the way we live. Few of us have noticed any difference; the changes have come so quietly that even many of the people who are closest to the new science are surprised at what it has been doing. Yet the evidences have been all about us.

—Television sets are a great deal less expensive now than they were a relatively few months ago.

—More and more tape recorders are being sold. Five years back, they were too costly for most people. Ten years ago, they weren't to be had at any price.

—New phonographs sound better than models just a few years old. There are many reasons, but one important contribution is made by a new-style pickup.

Collier's for September 3, 1954



small, are destined to replace scores of the complicated inventions of the last 40 years, from vacuum tubes to the agitators in washing machines

—A recent innovation in automobiles is a headlight that dims automatically as another car approaches.

—Are you reading this magazine by fluorescent light? Its glowing tube was one of the first harbingers of the new science. The photoelectric cell that opens doors automatically was another.

The exciting fact is not only that these changes are occurring (they're insignificant compared to what's coming), but that they are caused by little bits and pieces of solid matter—tiny, brightly colored rings, wafers and blocks, many of them no larger than the letter "o" on this page.

Some of these devices are taking the place of complicated wire and metal electronic gadgets; others are performing jobs that are entirely new, even revolutionary.

These little objects, or *stereatrons*, are tipping the electronics industry upside down. New ways to use them are being discovered literally faster than they can be developed. Some of the solids give off power when light is applied. Others give off light when power is applied. Some vibrate with tremen-

dous speed, a characteristic with great promise. Some change alternating to direct current, or amplify an electronic signal, or delay a signal for an instant—or remember it indefinitely.

In the latest television sets, certain *stereatrons* are replacing old-style rectifiers and transformers, at a considerable saving in cost (in addition, of course, the cost of TV sets has been cut sharply because of improved production techniques). The coating on the TV screen is composed of thousands of tiny *stereatrons*, and other *stereatrons* are beginning to take over the functions of the small tubes in all sorts of electronic equipment. The magnetic surface of the tape recorder, which "remembers" sounds fed to it, also consists of many tiny solids. Other solid devices are being used to help translate the vibrations of a phonograph needle into enjoyable sound.

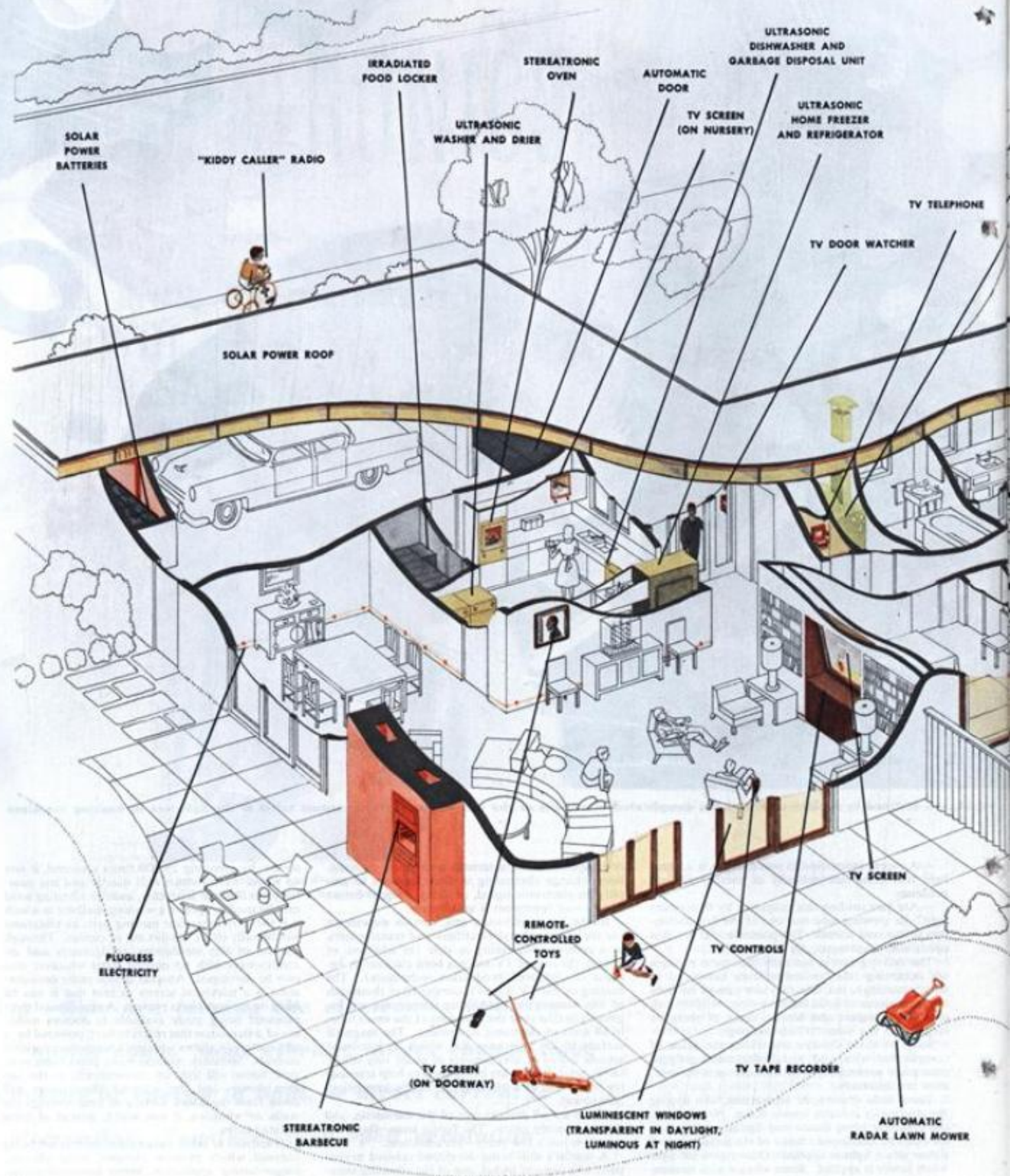
Those are all *present* uses of the *stereatron*, and there are many more. The future uses—those expected in just a few years—are countless.

A dentist's drill being developed consists principally of a piece of nickel, one of the vibrating *stere-*

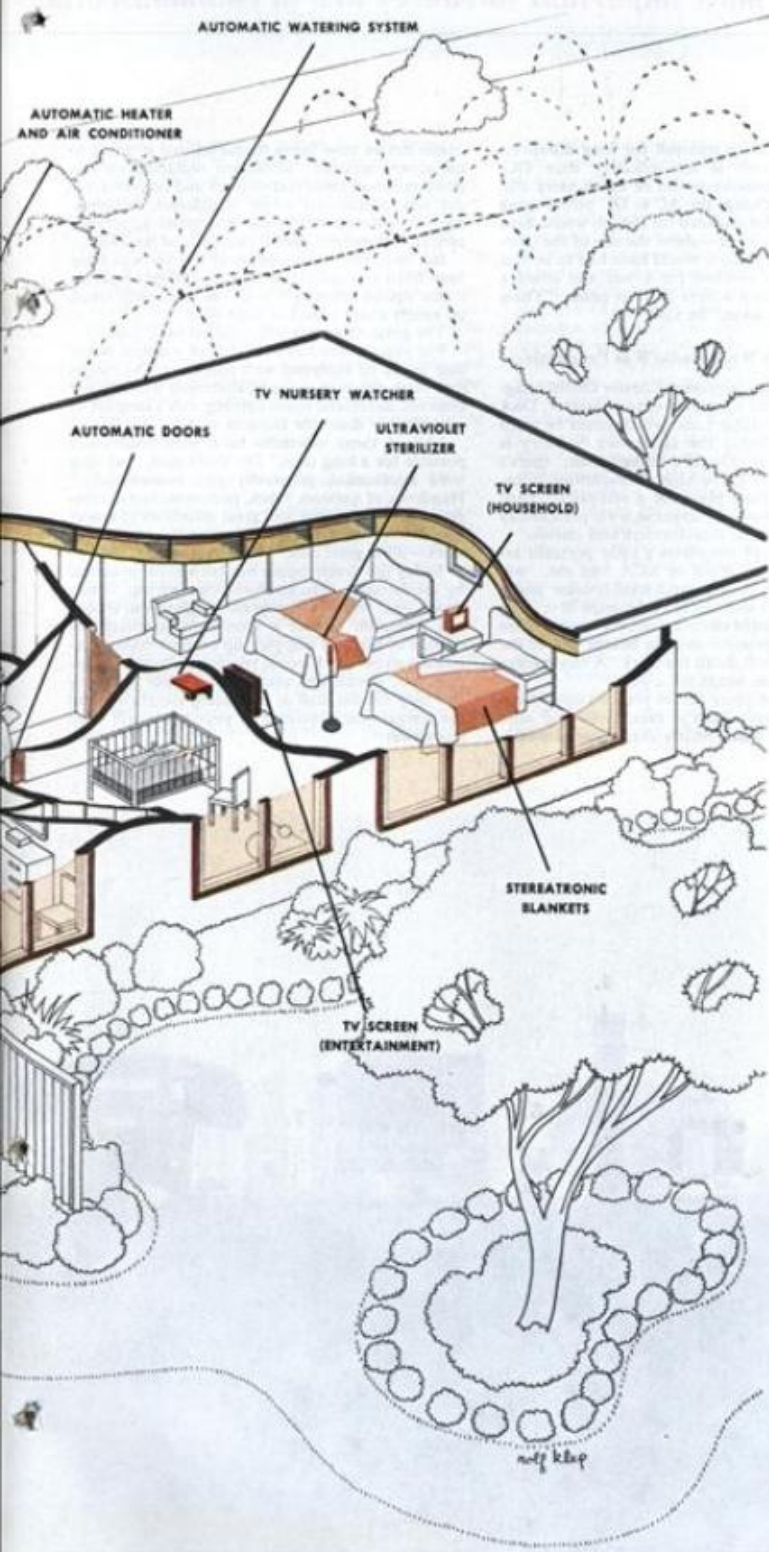
atrons; by vibrating 29,000 times a second, it sets up sound waves which drill quietly and less painfully. In the next few years, another vibrating solid may be used to operate a washing machine in which it is the only important moving part; its vibrations will literally shake the dirt out of clothes. Through the use of tiny *stereatrons*, refrigerators and air conditioners with no moving parts whatever also may be developed. Another device under consideration is a television screen so thin that it can be hung on the wall like a picture. A new clinical thermometer being made available to doctors makes use of a *stereatron* that reacts to heat; powered by a tiny battery, it shows a patient's temperature within seconds. Someday, not too many years from now, your house will light up automatically as the sun goes down—and the artificial illumination will come from the entire surface of your ceilings (or walls, or windows, if you wish), instead of from isolated bulbs.

Hundreds of other *stereatronic* devices are being planned which promise cheaper, more efficient, longer-lasting appliances, better communications.

Stereatrons have brought the electronic dream house close to reality. It will have



room-to-room TV and many wonderful appliances—inexpensive, efficient and automatic



improved transportation, new kinds of entertainment—even a general rise in the standard of living, through stereatronically operated factories. One of the most exciting projects envisions a tiny portable radar set which may provide the blind with a "picture" of the obstacles that lie in their path.

Progress in the field has been so fast that the scientists working in stereatronics—electronics engineers, physicists, chemists, metallurgists, ceramicists and mathematicians, among others—haven't even had time to compare notes. As a result, stereatronics hasn't developed a language of its own, as sciences usually do. In fact, until recently the science itself didn't have a name; physicists said they were working on "solid state physics," chemists referred to "materials research," and others used such names as "electronic solids," "solid state electronics," or simply "solid state."

How the New Science Acquired Its Name

While this report was being compiled, the word stereatronics (ster'e-a-tron'ics) was suggested by Collier's to fill a need felt by all of these scientists. It was derived, after consultation with both electronics experts and etymologists, from the Greek word for solids, *stereos*, and the word electronics. Defined as, "the science of the controllable electronic performance of solids," it is already in use among scientists in the field.

The lack of a name, according to some researchers, was a major handicap. It prevented co-operation among scientists working on various aspects of stereatronics, because they were unaware of the work being done by others. It added just one more complication to a science already beset by complexities.

"It takes nearly a full year of close teamwork on these solid devices," Dr. Lloyd T. DeVore, chief of General Electric's electronics laboratory, told me, "before our scientists and engineers can even begin to understand one another."

Stereatronics is a difficult science largely because it deals with the electrical and mechanical properties of matter—properties which defied comprehension for years and which even now experts find astonishing. In its 40 years of existence, the electronics industry has produced a variety of complex tubes, coils, transformers and so on, which have made possible the marvel of modern radios, television sets, lighting and the like. Now scientists are finding that the stereatrons do many jobs just as well, and some a great deal better.

The ironical fact is that radio engineers stumbled on the first practical stereatron long before there was any such object as an electronic tube, but failed to realize its significance.

Do you remember the galena crystal in the "cat's whisker" radio of the 1920s? Nobody knew why it worked, but it did unscramble radio waves as they came in on an antenna, and at the same time transmitted enough energy to vibrate the diaphragms in a pair of earphones, so the radio waves became audible sound. The galena crystal had major shortcomings as a radio receiver. It wouldn't amplify the sound it received, and it was exasperatingly inefficient at pulling the right signal out of the ether; you might spend hours poking at it before getting the station you wanted. It ultimately was abandoned in favor of the more effective vacuum tubes.

"For all the years since," said Dr. DeVore, "we've been inventing wonderful gadgets in glass, wire and metal to make all our electronic equipment work efficiently—while all the time, if we'd only known it, nature, with a little help from us, could have done the same jobs at a fraction of the power and cost."

Today nature is getting a second chance. One of the most important results will be the miniaturization of all sorts of electronic apparatus, from bulky computers to portable radios.

Some of the computers now in use are so big they occupy whole buildings. The same machines, using stereatrons, will be packed into a space not much larger than a couple of filing cabinets. Furthermore, they'll be more efficient, more economical and longer-lasting than any computer which can be made today.

Other examples are even more striking. "Most modern electric-powered locomotives," Dr. Paul Jordan of GE told me, "operate on alternating current because direct cur-

Stereatronic house of future may derive energy from sun, particularly if remote from conventional power. Plugless electricity will do away with wall outlets; appliance works when stereatron-tipped wire is set against wall containing electric circuit. Stereatronic barbecue will use radar. Watering system uses humidity-controlled stereatron; when lawn is dry, device starts water for as long as needed. TV screens show regular programs or adjacent rooms, as desired



Dr. L. Devore, GE, compares radio of today and (right) all-stereatronic set of the future. Disks are speakers



Swedish firm has developed a phone which, through use of transistors, is operated by push-button control

Many of the most important advances are in communications

rent is impractical to transmit for long distances. Alternating current is less effective than DC, though; the locomotive would be much more efficient if it could change the AC to DC before using it. But the rectifier required for the job would have to be ridiculously large—about the size of the locomotive itself. At least, it would have had to be that large once. He reached for a box and sifted a dozen silver-colored wafers into his hand. "These will do the trick soon," he said.

Dick Tracy's Wrist Radio Was Prophetic

Some years ago, cartoonist Chester Gould imaginatively presented his comic-strip character, Dick Tracy, with a portable radio which could be worn on the wrist. Today the electronics industry is catching up with Gould's imagination; there's scarcely a concern in the highly competitive industry that doesn't have plans for a vest-pocket-sized radio receiver that will dispense with present-day tubes, wires, sockets, transformers and chassis.

"The innards of tomorrow's little portable receiver," Dr. Irving Wolff of RCA told me, "will be nothing more than a small loud-speaker and a plastic plate with some lines and bumps in it. The lines will be a printed electrical circuit—metal strips etched into the plastic—and the bumps will be the little solids that will do all the work. A tiny battery will run the whole works for a year."

It will be some years before you can buy one of the little portables. They're expensive—and military needs come first. Nearly every type of sterea-

tronic device now being manufactured is going to the armed services. Solids are replacing various components in radio transmitters and receivers, radar sets, anti-aircraft target calculators, weapons-control systems, submarine acoustical apparatus, aircraft computers, guided missiles and the like.

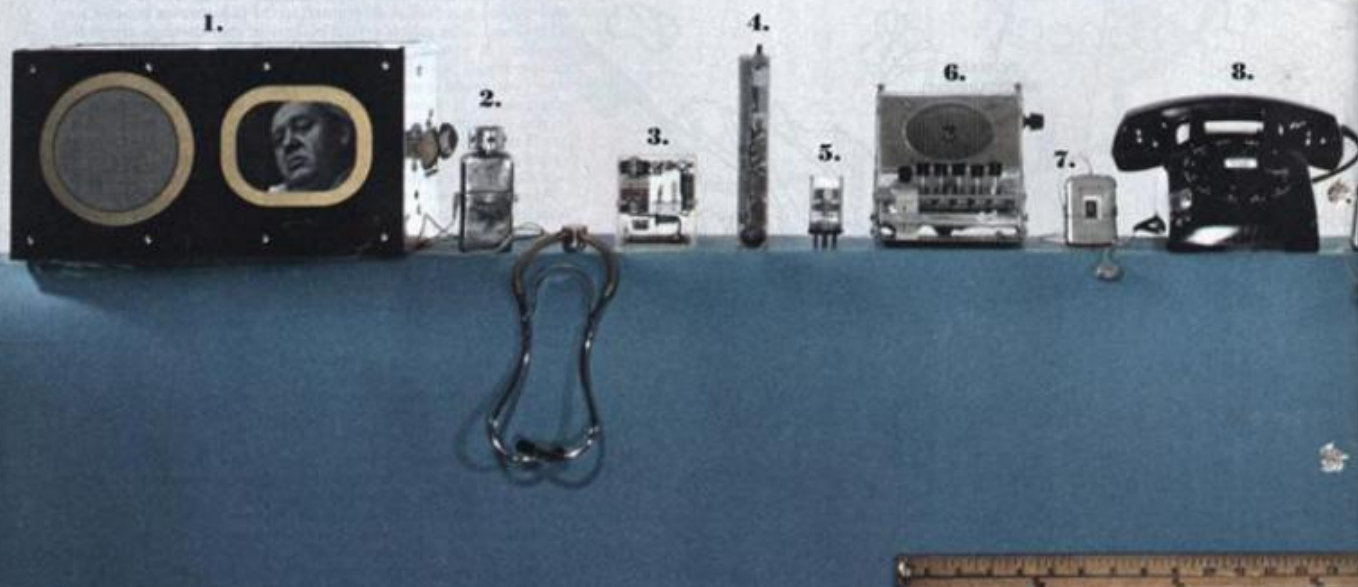
But once the requirements of the services have been filled you can expect a gradual flow of stereatronic equipment which, over the years, will touch on nearly every aspect of your life.

The greatest impact will occur in your home.

For years, there has been talk of a dream house that would be equipped with telephone-TV, ranges that cook meals in seconds, electronic temperature controls, automatic room lighting, and a long list of other highly desirable features.

"All of those advances have been technically possible for a long time," Dr. Wolff said, "but they were impractical, physically and economically." Hundreds of vacuum tubes, numerous metal components, miles of wire and great quantities of power would have been needed to make the equipment work—all at great cost.

Today the dream house has been made practical by stereatrons. Stereatron-studded wiring, strung inside your walls, will provide plugless and shockless induction power; a stereatron touching the outside of the wall will pick up current without requiring an outlet. Electric power will be less expensive, too: stereatrons used by the power company will help cut the cost of producing electricity, and the stereatronic appliance in your home will need less power.



—from tiny wrist radios to small, improved hearing aids

Some of the most important changes impending will be caused by the phosphor particle, a stereatron that gives off light when power is applied to it. A coating of phosphors is what makes the inside of a fluorescent light tube glow; and the same kind of coating, made bright in some places, dark in others, causes the picture to appear on your television screen.

A wall or ceiling panel coated with phosphors would become a source of light if an electric current were passed through it. Hook up a series of such panels to another of the stereatrons, one that reacts to the slightest change in outside light—and you have a setup that will turn on your house lights automatically as twilight falls, and keep increasing the intensity of the artificial light as the outside darkness increases.

Prospects for Picture-on-the-Wall TV

A new method of carrying electronic impulses to the phosphors on your TV screen will ultimately make possible picture-on-the-wall television. Instead of the bulky picture tube which now comprises nearly half your TV set, you'll have a flat screen that will be connected to your receiver by a few wires, and can be hung anywhere. The reason for today's long tube is the need for a so-called electron gun at the small end; it bombards the phosphor-coated screen with impulses that cause the tiny stereatrons to glow. The new screens will have a network of hair-thin wires which intersect behind each phosphor dot; as a signal hits the point where

the wires cross, the phosphor speck will light up to any degree of brightness that's ordered. The pictures can be in full color, of course.

Stereatronic advances will bring down the cost of television sets so that it will be practical to have a number of receivers and screens in your house. They will provide not only entertainment, but closed-circuit communication within the home, when used in conjunction with small, portable TV cameras (RCA calls them TV Eyes). The new cameras, about half the size of a telephone directory and weighing only a few pounds, will let you keep an eye on Junior in the playroom at the flick of a switch, or check to see who's calling when the front doorbell rings. The effectiveness of these midget cameras lies in a stereatronic coating on the face of a tube known as the Vidicon. This substance, a compound of antimony and sulphur, is sensitive to light. It also has certain properties which enable it to transmit as a TV signal the light variations (or pictures) it picks up—skipping a whole series of complicated amplifying operations required by large studio cameras.

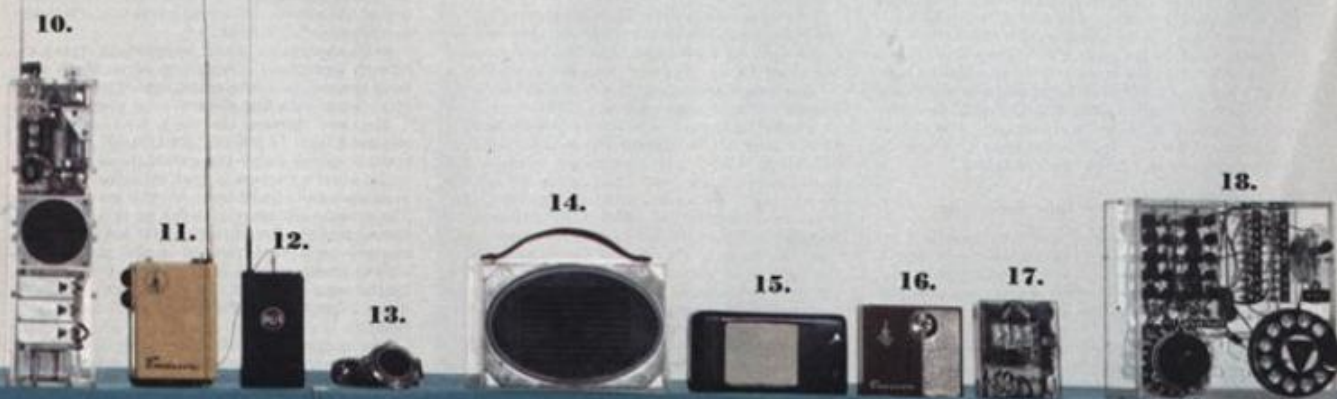
The RCA Vidicon tube (other companies have cameras of their own, some employing the Vidicon) costs about \$100 at present. The tube which does the same job in a studio camera is considerably more sensitive—but it's also 15 times as expensive, partly because it's so hard to manufacture that every second tube made has to be discarded because of imperfections. Of course, the Vidicon tube is only part of the camera; the complete Vidicon camera costs about \$900, far too much for general



A new stereatronic tape can record both sound and picture for video. Screen above shows how image looks

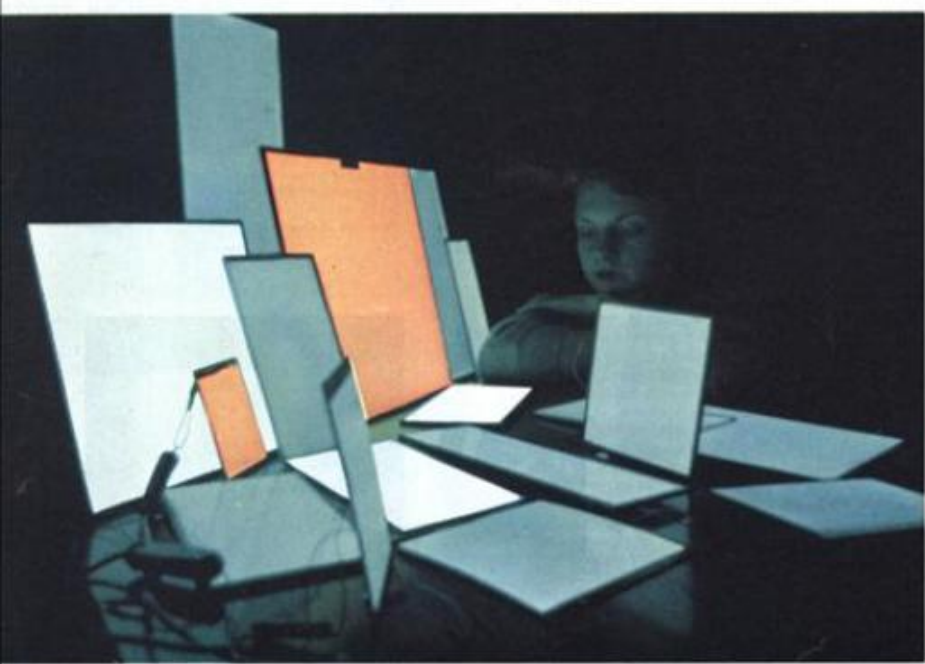


One TV color screen uses phosphor lines—shown magnified—"trained" to reproduce given color on demand



With stereatrons, many devices will be smaller, many completely new. Photo shows sampling of both types. 1. Portable TV set (RCA) runs on batteries, uses an tube but picture tube. 2. Electronic stethoscope (by Maico). 3. An FM amplifier-transmitter. 4. Portable wireless microphone. 5. High-fidelity amplifier. 6. Transistorized intercom set (all RCA). 7. Hearing aid (Zenith). 8. Phone (Bell) has volume control for deaf users. 9. Hearing aid (Maico). 10. A portable field receiver (Sylvania). 11. A walkie-talkie (Emerson). 12. A walkie-talkie (RCA). 13. Wrist radio receiver (Sylvania). 14. Portable radio has 6-inch speaker—because other components are miniaturized (RCA). 15, 16 and 17. Pocket portable radios (RCA, Emerson and GE). 18. Desk-size stereatronic computer (Sylvania).

One stereatronic experiment, though still at an early stage, holds dramatic promise:



Panels that light when current is applied to them may someday illuminate your house. Light is dim now (as shown by face of Sylvania worker Grace Daly) but future versions will be brighter

household use. However, the addition of other stereatronic devices is expected to lower the price substantially—perhaps down to \$150 or \$200.

And that will be a bargain indeed—because besides watching the baby, the Vidicon camera can be adapted to take home movies on magnetic tape. No processing will be required and you won't need a special projector. You'll simply play the video tape back through the recording apparatus and see on your TV screen, in full color and with sound, the pictures you shot a few minutes before.

New Fields for Tape Recordings

You'll also be able to use your recording apparatus to tape your favorite television shows. Moreover, you'll be able to buy video tape recordings of musical stage shows, just as you now purchase your phonograph records or 16-millimeter home movies.

Color video tape recording has already been developed experimentally, but for studio use only. The method is somewhat similar to standard sound-recording techniques on magnetic tape, but much more complicated.

The tape is covered with magnetic oxide particles. As it passes through the recorder, the tape picks up and stores away five signals, which comprise a sort of electronic shorthand. There's one signal each for the three primary colors, another for the sound track and a fifth which synchronizes sight and sound (the tape "remembers" the five signals because the electronic impressions rearrange the form of the magnetic coating). When the video tape is played back, this compact code, like a punched music roll on an old-time player piano, reproduces all the signals simultaneously as sound-and-color TV. Right now the process requires a complicated battery of equipment which fills one whole wall, but in time, RCA Chairman David Sarnoff says, "low-cost video tape equipment of simpler and more compact design than the

studio-type apparatus we now have can be made available."

Television also will be adapted, eventually, for use in conjunction with the telephone. But that advance will take a while, perhaps 20 years or more. Sending a TV picture from one room to another is a fairly simple procedure. Sending it to the house down the block is somewhat more difficult, because no simple equipment now known will transmit a picture over any substantial distance without amplification. City-to-city transmissions require the use of coaxial cables; the latest cables are capable of carrying 3,600 voice signals (that is, 1,800 conversations)—but of the cable's 3,600 channels, no less than 1,200 are needed to carry a television picture! To be sure, TV pictures can be transmitted through the air without the use of wires, but there simply aren't enough frequencies in the spectrum to carry the number of pictures that would result from widespread use of TV-phones.

It's a difficult problem, but not insoluble. As more and cheaper circuits come into existence and new transmission methods are developed, the videophone will become available. You'll just have to wait a little longer than for some of the other stereatronic advances.

But you won't have much of a wait for another telephonic development. By making use of the transistor (the most famous of the stereatronics, consisting of a tiny solid within a plastic or metal case), Bell Telephone engineers have already made direct long-distance dialing available in some communities, and they hope to have 20 exchanges converted to it by the end of this year.

The transistor will improve telephonic communication in other respects, too. Jack A. Morton, in charge of transistor development at Bell Laboratories, explained how.

"In a modern telephone switching office, to handle 10,000 subscribers at top speed we need 40,000 to 50,000 relays or switching units," Morton told me. "We'd like to replace these metal units

with vacuum tubes, which work 1,000 times as fast. But the average tube has a life expectancy of only a few thousand hours; with 40,000 tubes, we could expect one to fail every six minutes. And think of the heat the tubes would generate; obviously, tubes would be impractical.

"Transistors may solve the problem. They'll do the same job as vacuum tubes, using only a fraction of the power. Unlike tubes, they need no warmup. And above all, they're rugged: you can drop them or shoot them out of a gun—there's nothing to break. Properly made, they should last years."

Transistors for Smaller Hearing Aids

Some transistors are already on the market, but they cost from \$3.75 to \$50. Ultimately they should be available for less than a dollar. Meanwhile, they are being built into at least one consumer product. Zenith, Sonotone and Maico have used the little solids to replace tubes in hearing aids; as a result, the appliances have been reduced to about the size of a cigarette lighter—small enough to be hidden in a woman's hair.

Within the next few years, more and more transistors will be channeled into civilian production. That doesn't mean you'll be able to yank the tubes out of your radio and substitute the little stereatronics. New circuits will be needed; you'll have to buy another radio. But—eventually, at least—transistorized radios and TV sets will be cheaper than present sets, and much longer-lasting.

Industry is already gearing up for the transistor bonanza. A number of electronic manufacturers—including such major firms as Raytheon, RCA, GE, Philco, Westinghouse, Sylvania and Western Electric—are producing transistors. Others, like Zenith, Capehart, Admiral, Arvin, Emerson, Crosley, Hallicrafters and Stromberg-Carlson, have teams of researchers at work developing experimental transistorized equipment.

"It's like an Oklahoma land rush," said Professor Frederick Seitz of the University of Illinois, one of the pioneer solid-state physicists. "Nobody can afford to lag behind."

Bell Laboratories, which invented the transistor, recently announced another new device that's even more spectacular (although of limited usefulness so far): the world's first efficient solar power system.

The sun showers the earth with more than one quadrillion (1,000,000,000,000,000) kilowatt-hours of energy daily—comparable to all the energy in the world's reserves of coal, oil, natural gas and uranium—and almost every bit of it goes to waste. The greatest efficiency achieved up to now in converting sunlight directly into power has been about one per cent—for example, in the photoelectric cells in photographers' light meters. Bell's experimental solar power set (which, incidentally, is not much larger than a light meter) is six times more efficient.

The pocket-sized Bell solar energy converter is simply made. It consists of 10 razor-blade-thin wafers of specially treated silicon, each 2¼ inches long and half an inch wide. These sensitive strips are linked together with thin wires which run to two terminals. From the terminals the converter is connected to the power-consuming appliance.

When the sun's rays hit the sensitive silicon, sufficient power is produced to run low-current equipment; in demonstration, the device ran a cigarette-pack-sized transistorized radio and a toy Ferris wheel. Although Bell scientists estimate that in its present experimental stage it would take about 25 square feet of silicon wafer to keep a 100-watt lamp burning, the efficiency of the device is expected to increase considerably. Even now, telephone engineers are considering using units to run low-power mobile equipment or as battery chargers for amplifiers in rural telephone systems.

To power a small home from the sun's rays right now you'd need a silicon-surfaced roof covering a quarter acre or more—plus a battery so big it

new "eyes" for the blind

would fill two rooms, to store power for use at night. But scientists believe the solar-powered home may become practical someday, at least in parts of the world where conventional electrical power is now nonexistent or extremely expensive.

Although it's doubtful that solar power will be cheap enough in our lifetime to power great factories, other stereotronic advances may revolutionize the operation of industry. Chief among these are the projected computers—small in size, efficient beyond anything now known, and cool in operation. Even the relatively clumsy computers of today are taking over many industrial chores, particularly in accounting, inventory-taking, and certain self-service operations. The streamlined "electronic brains" of the near future may take over the whole factory.

"Suppose," said Dr. Samuel B. Batdorf of Westinghouse, "that a factory requires 100 machines to manufacture its product, all doing different jobs and running at differing speeds. Today, 100 operators are needed to watch the dials and regulate the speeds. In principle, one computing machine could do the job better, 'reading' one dial in a few millionths of a second, and instantly sending instructions to motors controlling the speeds. Then the same computer could turn its attention to the next machine, and so on. It would take about one second to control all 100 machines. One reason it hasn't been tried so far is the limitations of the vacuum tubes. But solid devices make it possible."

Devices That Will Benefit the Blind

The new science of the solids seems certain to change the world in highly dramatic fashion. But what may be the most dramatic change of all will affect only a tiny minority of the world's population: the blind.

At the Massachusetts Institute of Technology a team of scientists under the direction of Dr. Clifford M. Witcher—himself blind—is developing an electronic-stereotronic bag of tricks which eventually may make it possible for a blind man to "see" where he's going through a series of impulses communicated to his hand. The scientists have most of the facts they need right now, but—as MIT's Professor J. Earl Thomas puts it—"the blind man would need a trailerful of tubes, radar equipment and other components." Stereotrons, by sharply reducing the size of the equipment required, will go a long way toward solving that problem.

At present Dr. Witcher is working on a preliminary device which indicates to a blind person the whereabouts of stairs, curbs and similar "step-down" obstacles. The blind man holds a boxlike apparatus with a light which scans his path; when it strikes something, the reflection causes the handle of the box to vibrate. "At the moment," said Professor J. B. Wiesner, director of MIT's electronics research laboratories, "the device is only experimental and years of development are needed before it can be made practical . . ."

"But eventually," Professor Thomas told me, "by using all types of stereotronic devices, we'll be able to produce a radar-type instrument which will paint a map in Braille for a blind person. My guess is that this apparatus will be about the size of a woman's handbag. The blind person will place one hand on the outside of the bag and feel the whereabouts of everything in front of him."

No one is more impressed by the tremendous new avenues of progress opened up by the stereotrons than are the scientists themselves. "You might sum up the significance of the new science this way," said Dr. Henry O'Bryan, manager of Sylvania Electric's physics department. "First came electricity, then electronics. Now we're beyond electronics into something just as far-reaching."

Or, as RCA's General Sarnoff put it: "Science and electronics are moving so fast that in ten years everything we're now seeing will be so obsolete that we won't recognize them . . ."

Collier's for September 3, 1954

Dr. Clifford Witcher, blind scientist of MIT, demonstrates his experimental device to assist sightless in locating obstacles. Light causes photoelectric cell to set up vibrations in box handle



The 400-Mph Passenger Train

It may ride on air cushions rather than on rails, and be driven by jets or even rockets. A number of far-out ideas are competing for serious development. And industry is studying a big new market.

By 1980, unless something drastic is done about it, traffic in the populous northeast corridor of the U.S. between Boston and Washington will have reached an imbalance and impasse of monstrous proportions. Already, super-highways in key metropolitan areas are reaching congestive saturation, though close to \$2 billion has been spent on those in the corridor alone since 1945. And congestion in air-lane and airport facilities, on which over \$1 billion has been spent in the same period, is already severe. By 1980, preliminary studies show, the corridor's population will have jumped by some 25 percent to well over 50 million. At the same time travel between cities, in the increasing mobility of the era, will have more than doubled or tripled.

The indiscriminate proliferation of superhighways seems less and less of a solution. For one thing, rights-of-way are getting hard to come by and costs are steeply rising, not only in dollars but in land blight. Eventually, if highways spin out unchecked, the whole northeast corridor, following the pattern of Los Angeles, will be largely concrete. Perhaps the superhighway quandary is best illuminated by a proposal last year to double part of the already overburdened New Jersey Turnpike from six lanes to twelve, at a cost of some \$350 million. The Port of New York Authority, whose cooperation is required, blanched and promptly cried halt, for not only are the tunnels connecting the turnpike to New York incapable of carrying the added traffic, but no one would know where to put it once it got into Manhattan. Ultimately, if this madness continues, cities will have to hang out signs similar to those on their parking lots: "Full up."

While congestion on roads and airways was everywhere growing worse, the railroads, historically the most efficient mass movers of people and goods, have been suffering a precipitous drop in traffic. This is not the place to go into the well-known plight of the railroads, delicately balancing the blame between government misdeeds and private mismanagement. The signal fact is that today 91 percent of all intercity passenger travel, including commuter traffic, is by automobile. Of the remainder, the railroads get only 3 percent, where once they had nearly all.

The railroads struggled against this tide. In the last decade or so technical improvements plus tax easements have won back freight traffic and a measure of profitability.

And since World War II all manner of new equipment has been tried, including lightweight cars, Talgo trains, and new sleeper services, to win back passengers. But all these measures represented only marginal improvements, thinly spread, upon a transportation system basically unchanged since the last century; no substantial increase in passenger-train speeds has been shown since 1900. Against the rising power of the automobile and aircraft, aided by massive federal subsidies for highways, airports, and aeronautical research, the railroads fell further and further behind in the *sine qua non* of twentieth-century travel—speed, comfort, and convenience. Their grimy, cavernous terminals took on the aura of a departed age.

As passenger volume melted, most railroads, primarily freight carriers to begin with, found passenger services becoming a fifth and flat wheel on operations and earnings. Under the burdens of an outmoded system, archaic labor practices, and encrusted rules and regulations, every passenger lured back only added to the enormous running deficits. By 1960 over 100,000 miles of track had been taken out of passenger use, and one route after another was being cut back or terminated. As the railroads abdicated their role as passenger carriers, the government was forced to put up ever mounting funds just to keep some vital but decrepit lines running. Over \$40 million has been pumped to date into the rickety New York, New Haven & Hartford Railroad, with no end in sight. Most railroad men, except for a few hardy Westerners, became convinced that passenger traffic was something to be shunned. Some even predict that most railroads will be entirely out of the passenger business by 1970.

But precisely at this depressing juncture some startling developments are under way to reverse the outlook. After years of inaction, government is joining with research science, inventive engineering, and advanced industrial skills in pursuit of a new vision of superhigh-speed ground transportation.

A new transportation vocabulary

The passenger from Boston enters a train of long, slim cars shaped like projectiles. Soft music plays as he sinks into a contour chair, straps on a seat belt, and tells a pretty hostess his destination—Washington. With a slight, almost imperceptible lift, the train takes off down a gleaming metal tube, swiftly gaining speed until it reaches a steady, smooth, softly suspirating 400 miles per hour. At Providence, Hartford, New York, and other intermediate points, the train, without slackening speed, spins off cars and picks up new ones via high-speed feeder loops. Somewhere between Providence and Wilmington the passenger has a haircut in the lounge's barbershop, orders a snack and a drink, and watches an up-to-the-minute newscast. Just

by Lawrence Lessing

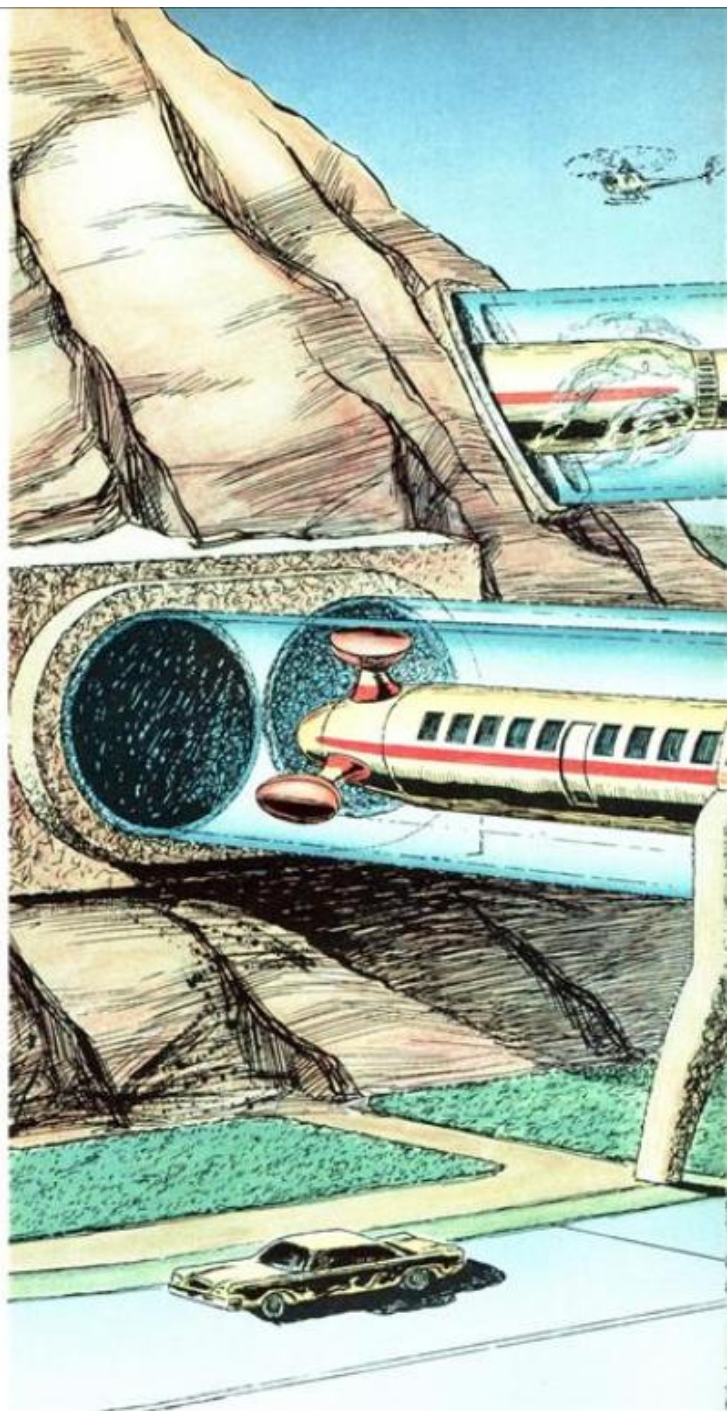
before Baltimore he picks up a phone and completes his arrangements in Washington. The trip, door to door, takes something under two hours.

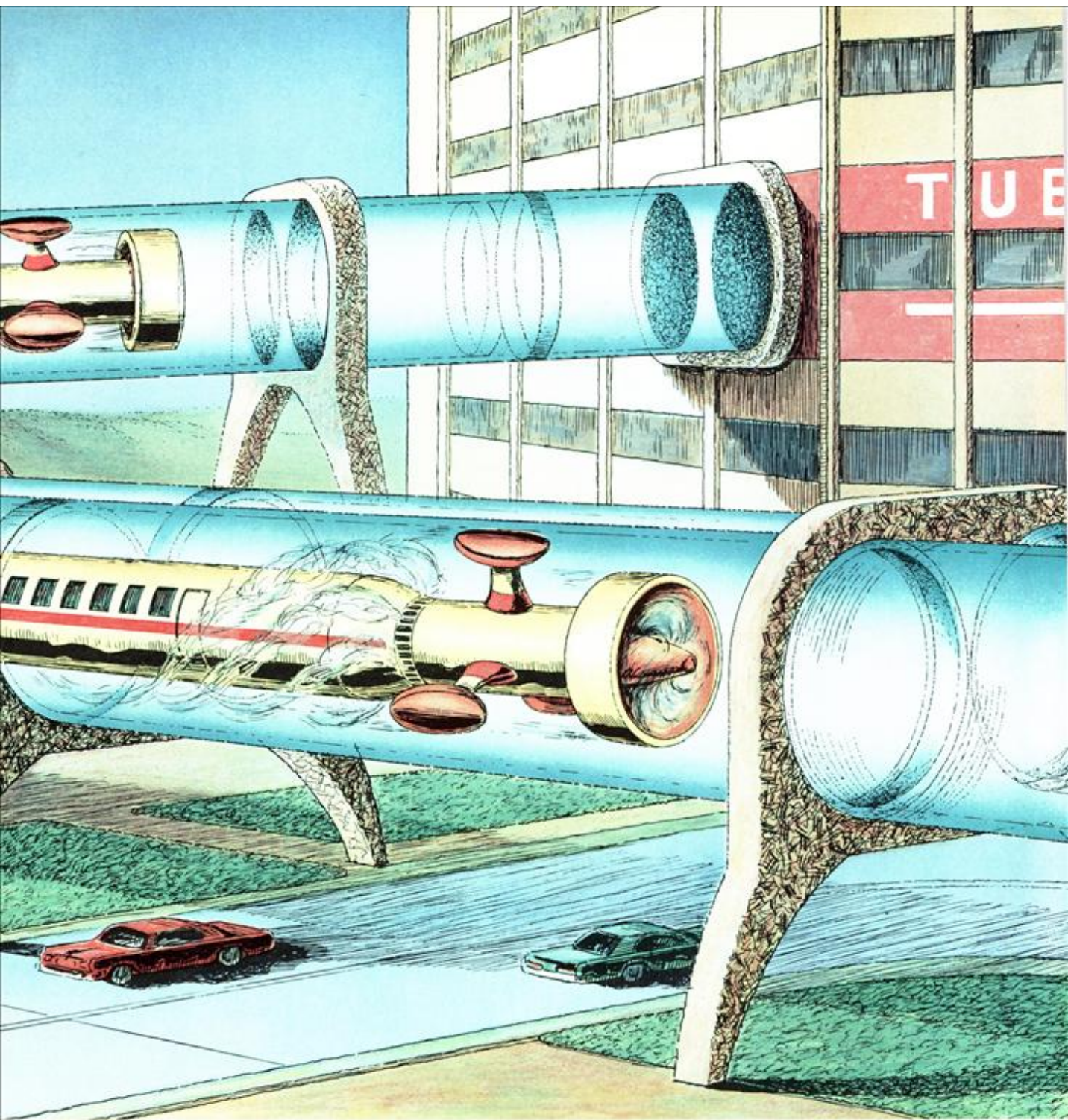
This vision may appear to be the purest moonshine to the much-jolted and discouraged riders of today's railroads. Yet all of it is well within the abundant technological resources of the day. And the tubular train is only one of half a dozen devices being seriously considered by the Northeast Corridor Project, a federal program designed to demonstrate what can be done to rejuvenate mass ground transportation in the densest traffic area in the U.S. The project was initiated in 1962 by the late President Kennedy. After a task-force study, he directed then Secretary of Commerce Luther H. Hodges to undertake a thoroughgoing exploration of what government might do to improve and coordinate all transportation in the critical corridor. Before his retirement early this year, Secretary Hodges set a goal of 200-mile-per-hour rail travel between Boston and Washington to cut travel time from something over eight hours to something under four. The project is now completing its preliminary planning phase and is ready to take off on its first active research stage, with a boost from President Johnson's State of the Union Message and a slated fiscal budget of \$20 million.

This program is not to be confused with the federal mass-transit program, administered by the Housing and Home Finance Agency, which has an initial budget of some \$400 million to aid cities in shoring up and improving present commuter services—an entirely different, short-range, and specialized problem. The Northeast Corridor Project looks beyond this to a longer-range, more basic technical solution to transit problems, and specifically to intercity travel. For it quickly discovered that a great gap exists in really basic research on advanced ground-transportation systems, due to over half a century of neglect by the industry as well as government.

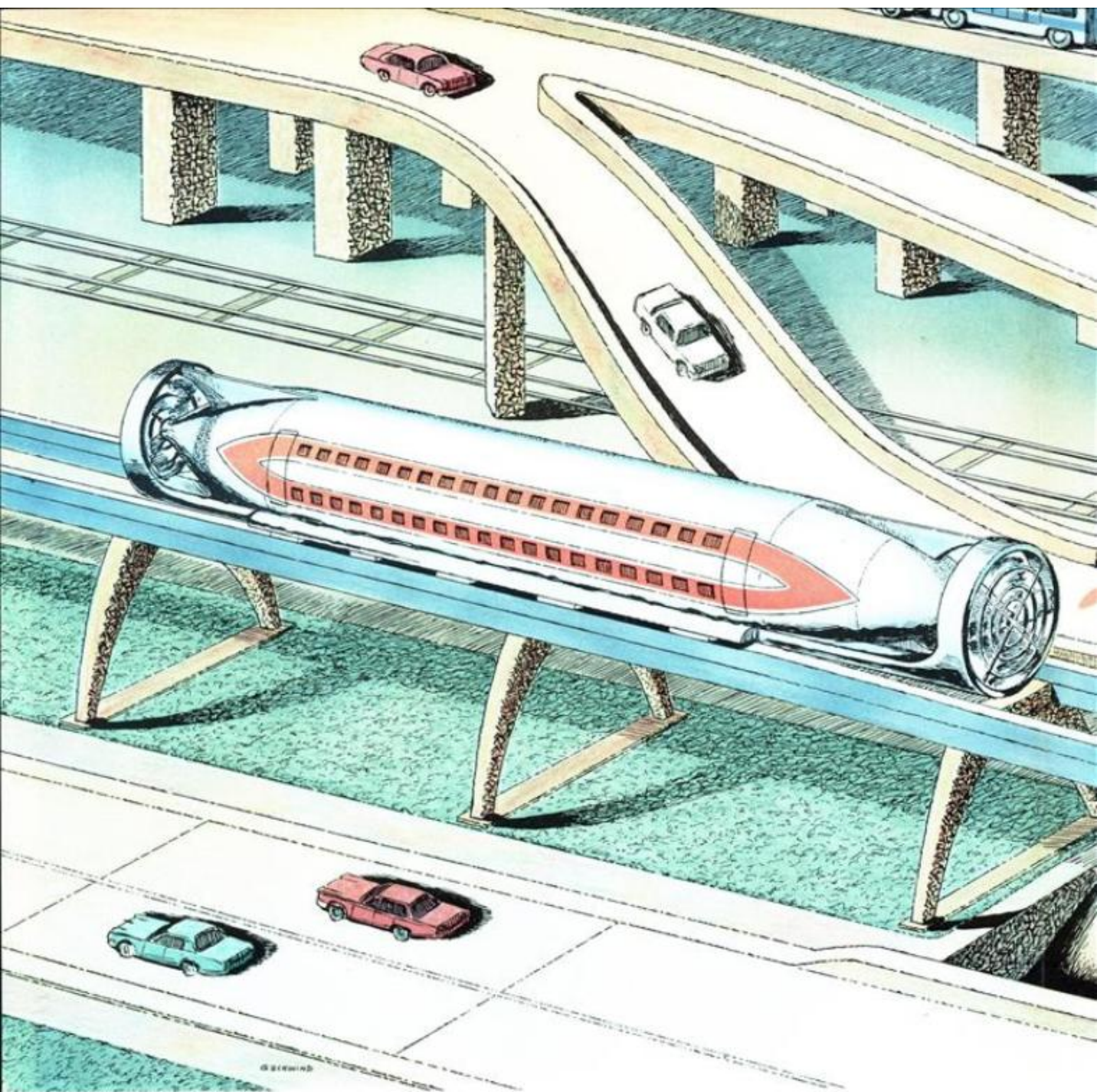
Without delay, therefore, the project's director, Dr. Robert A. Nelson—a transportation expert brought in from the University of Washington in 1963—let a \$500,000 study contract to the Massachusetts Institute of Technology to make a broad survey of all the technological possibilities. The M.I.T. report is due this June. A major part of its job is to block out broad research projects and areas—such as propulsion, guidance, computer control, and network layout—in which the government might profitably invest research funds, looking toward the final construction of a new system. To keep an open mind about what that system may be, as well as to stay out of the rut of railroad thinking, M.I.T.'s engineers use the term "guideways" instead of rails, "vehicles" instead of trains, and they borrow freely from the concepts and proved techniques of aerospace system development.

continued page 208

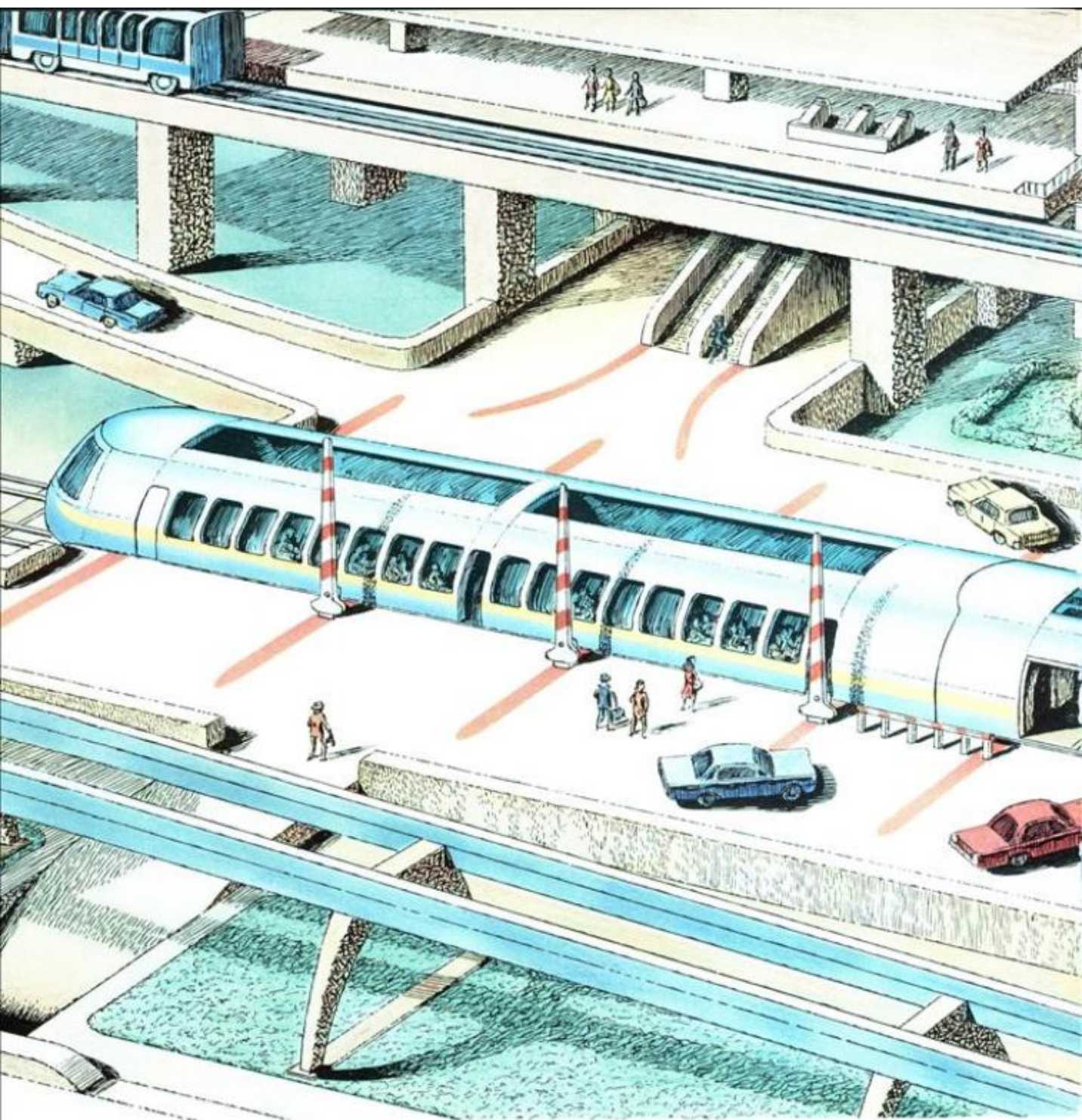




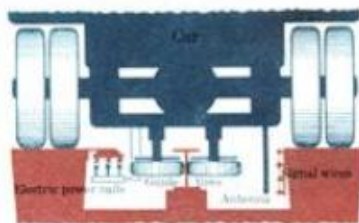
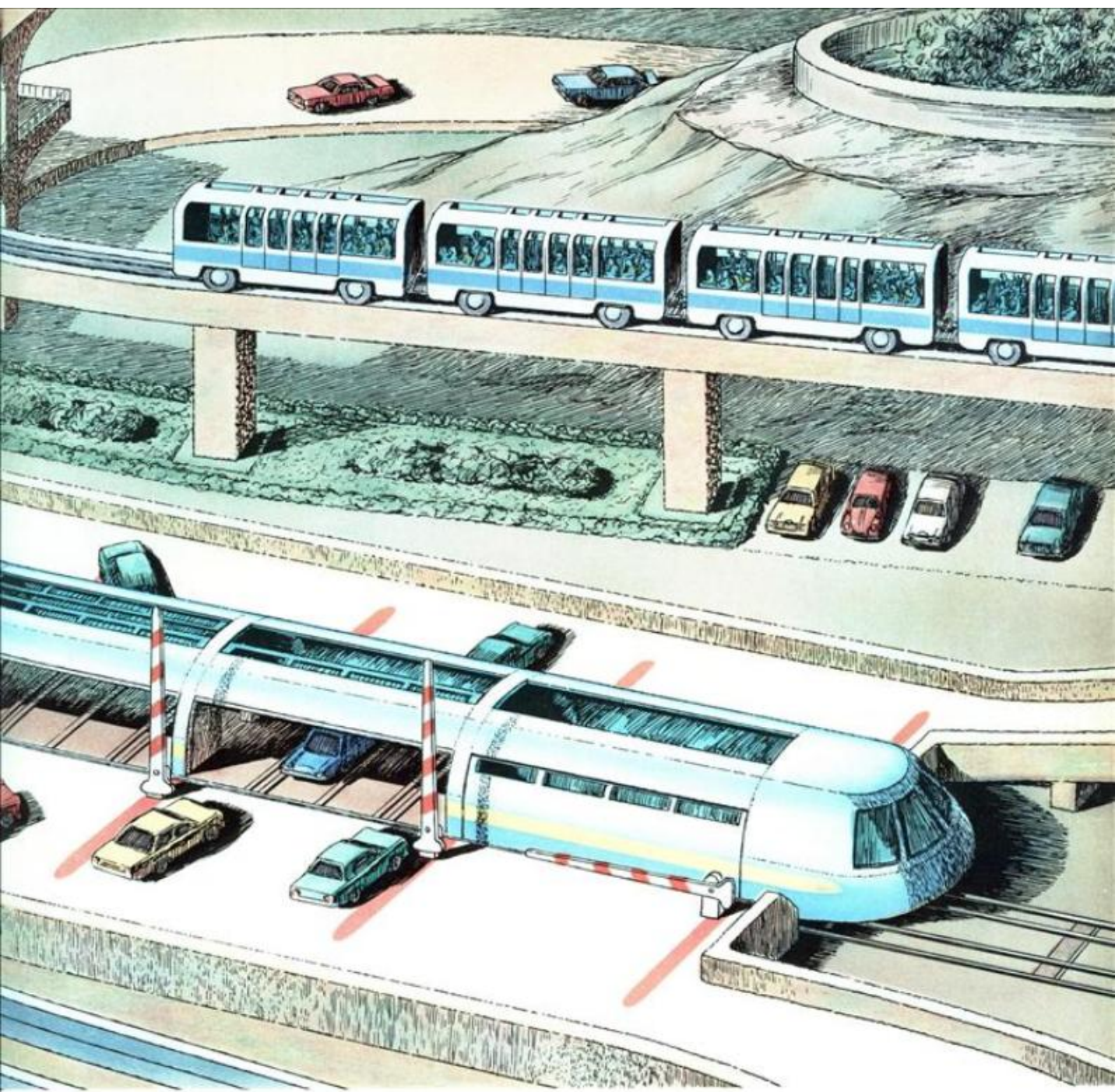
New Yorkers with business in Washington may someday make the trip in sixty minutes flat—through a tube. This system is one of the further-out schemes for mass transportation now being explored by the federal government's Northeast Corridor Project. It was conceived by Dr. Joseph V. Foa, head of Rensselaer Polytechnic Institute's department of aeronautical engineering and astronautics. The 130-foot vehicle pictured here would carry 104 passengers. Powered by turbofan jets and riding on six huge air-cushion pods, it would slip through the tube at near-frictionless speeds of 250 to 400 miles per hour. The tubes—transparent in this painting to reveal the vehicles—would actually be steel casings fifteen feet in diameter. Like huge pipelines, they would bore through rock, run underground, on the surface, or on elevated structures. Some engineers think that the tunnels would run more straight and stable 500 feet underground.



Three trains of the future are shown in this entirely imaginary montage. Directly above is the Levacar, which slides on a thin cushion of air over an elevated system of smooth, square guide rails. It was worked up to the laboratory-model stage by the Ford Motor Co.'s research and engineering division. The principle (see diagram, left) was devised by Dr. Andrew A. Kucher, research director at Ford until his recent retirement. Instead of wheels, the Levacar has a series of perforated metal plates, called "levapads," through which a compressor pumps a thin film of air between the plates and the guide rail beneath, raising the plates a fraction of an inch off the rails. The vehicle glides, under a minimum of power, on the air film. A safety flange, attached to the levapad assembly, prevents derailment. The double-deck Levacar shown here would be powered by turbo-propellers and carry 200 passengers at speeds of 150 to 350 miles per hour.



The big auto-ferrying train, center above, is General American Transportation Corp.'s answer to the mass-transportation problem. It was conceived by Deodat Clejan, the company's director of transportation planning. The idea is to lure intercity auto travelers off the highways by enabling them to take their automobiles along with them at speeds up to 200 miles per hour and at fares equal to toll-road mileage costs. The train would be made up of huge, 24-foot-wide, 128-foot-long cars operating on 18-foot-gauge tracks and a special roadbed. Propulsion would be conventional third-rail electric, but entirely automatically controlled so as to permit safe service at intervals as close as five minutes between trains. Passengers would drive their autos through automatic tollgates onto the train, relax in lounges provided at one end of each car, and have their own cars handy for use at the end of the journey. A few all-passenger cars would also be included.



The feeder line of small trains at the top of the page is Westinghouse's new, all-automatic Transit Expressway system, an advanced, short-range commuter system of a type that may eventually link into a long-range, high-speed, intercity system. The computer-controlled trains are composed of lightweight electric cars holding twenty-eight passengers each, riding on rubber tires at speeds of fifty miles per hour and at two-minute intervals on a special roadway. The cars are steered front and rear by means of pneumatic guide wheels running against an I-beam rail in the center of the roadway (diagram, left). Wires on the rim of the roadway would transmit all operating data and orders to and from automatic controllers at each station. A full-scale, \$5-million demonstration of the system will be made this summer on a two-mile loop track in Pittsburgh's South Park, jointly sponsored by federal, state, and local government, and local industry.